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Effects of a Mindfulness-Based Virtual Reality Intervention on Life Satisfaction, Happiness, and Flourishing in College Students: A Pilot Study

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College students experience a wide range of academic, developmental, and societal stressors, placing them at increased risk for psychological distress and poor mental health. Mindfulness-based virtual reality (MBVR) interventions have shown growing promise in supporting student mental well-being. Recent research has called for a shift from solely reducing psychological symptoms toward promoting positive psychological outcomes. Therefore, this pilot study examined the effectiveness of an MBVR program in enhancing life satisfaction, happiness, and flourishing among college students. This study utilized TRIPP, a commercially available VR application. A total of 19 college students participated in eight 15-minute sessions over the course of one month. Survey instruments were administered at two time points: prior to the intervention (T1) and after its completion (T2). Paired samples t-tests revealed statistically significant improvements in participants' life satisfaction, happiness, and flourishing levels following the intervention. The findings suggest that MBVR holds promise as a proactive and engaging tool for promoting mental well-being in non-clinical, preventive settings such as college campuses. Furthermore, while prior research has primarily focused on alleviating symptoms such as anxiety and depression, this study contributes to the literature by demonstrating that MBVR can also enhance positive psychological outcomes. Future research should utilize larger, more diverse samples to improve the generalizability of these findings. Several practical implications for educators and practitioners are discussed.

Keywords: Virtual reality, mindfulness, mental health, college students, happiness, positive psychology

College students have been considered as a stress at-risk group (American College Health Association, 2023). They face not only academic stressors (e.g., academic workload, financial concerns, competition and pressures), but also various developmental and societal stressors common at their age, including uncertainty about the future, societal challenges, and issues related to self-identity (Buchanan, 2012; Freire et al., 2020; Hurst et al., 2013; Liu et al., 2019). Studies have shown that college students report high levels of depression, anxiety, and stress, and this trend is observed globally (Bayram & Bilgel, 2008; Iqbal et al., 2015; Mohd Sidik et al., 2003). Additionally, college students' psychological distress is closely associated with both academic outcomes (e.g., GPA, dropout rates) and overall health and well-being (e.g., substance use, suicide, and self-injurious behaviors) (Arria et al., 2013; Eisenberg et al., 2009; Paul et al., 2024). Given that psychological distress can extend beyond college and continue to affect individuals into later adulthood (Cooke et al., 2006; Eisenberg et al., 2007), addressing college students' mental health is a critical and urgent priority.

Research indicates that campus mental health services are not adequately meeting the growing needs of students (Weissinger et al., 2024). In particular, due to barriers related to accessibility and cost, many students inevitably rely on on-campus resources (Stewart et al., 2015). However, students often hesitate to use these services because of stigma, religious beliefs, cultural values, and other personal factors (Han & Pong, 2015; Kosyluk et al., 2016). Moreover, campus mental health services frequently face internal challenges, such as inadequate funding and a shortage of qualified staff, making it unrealistic to expect traditional services to comprehensively address all student needs (Prince, 2015). Therefore, a more innovative yet feasible approach is needed to support the mental health of college students.

Prior studies have provided strong evidence that mindfulness interventions can effectively improve mental health (Feicht et al., 2013; Terzioğlu et al., 2024). Mindfulness involves the practice of being fully aware of the present moment with an open and non-judgmental mindset (Lomas et al., 2015). Deep et al. (2025), in their

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review, reported that college students who participated in mindfulness-based practices consistently experienced reductions in stress and anxiety, along with improvements in cognitive functioning.

Despite its demonstrated effectiveness, traditional mindfulness-based interventions face limitations related to participant engagement and accessibility (Osborne et al., 2023). Specifically, some studies have reported that these traditional programs require sustained attention and commitment, with high dropout rates being common, particularly when facilitator support is lacking (Banerjee et al., 2017; Winter et al., 2022). Furthermore, traditional programs typically require in-person instructors and fixed scheduling, which may exclude individuals living in remote or underserved areas from participating (Birtwell et al., 2021; Martinez et al., 2015). More importantly, much of the existing mindfulness research has primarily adopted a deficit-based model of health, focusing on reducing negative psychological symptoms such as anxiety and depression (Allen et al., 2021).

To address these limitations, recent efforts have integrated mindfulness programs with virtual reality (VR) technology (Modrego-Alarcón et al., 2021; Sadowski & Khoury, 2022; Wren et al., 2021). To date, mindfulness-based VR programs (MBVR) have been found effective in promoting various aspects of mental health across different populations (Ma et al., 2023; Puente-Torre et al., 2024). Therefore, the present study aimed to investigate the efficacy of MBVR in promoting the mental health of college students.

Life Satisfaction, Happiness, and Flourishing

In the field of mental health and psychological intervention, previous research has predominantly focused on reducing negative psychological symptoms such as stress, anxiety, and depression (Bamber & Morpeth, 2019; Chen et al., 2023; Ma et al., 2023; Reangsing et al., 2023). While such approaches are essential for clinical care and early diagnosis, they often overlook students who may not meet diagnostic thresholds but still struggle with emotional challenges. To address this gap, there is increasing attention on positive psychological constructs such as life satisfaction, happiness, and flourishing (Huppert & So, 2013; Schotanus-Dijkstra et al., 2017).

Diener (1984) defined happiness as comprising frequent positive affect, infrequent negative affect, and high life satisfaction. Pavot and Diener (1993) described life satisfaction as a conscious, global evaluation of one's life circumstances, distinct from temporary emotional states or moods. Keyes (2002) conceptualized flourishing as complete mental health, encompassing emotional well-being (positive feelings), psychological well-being (e.g., purpose, self-acceptance), and social well-being (e.g., social contribution and integration). Diener et al. (2010) conceptualized flourishing in terms of an individual's success in relationships, self-esteem, purpose, and optimism.

Regarding the relationships among these three constructs, VanderWeele (2017) suggested that flourishing represents a broader concept of well-being that encompasses both happiness and life satisfaction. Several studies have supported this perspective, demonstrating that flourishing integrates elements of both happiness and life satisfaction (Rahe et al., 2023; Ruggeri et al., 2020; VanderWeele, 2017). Specifically, Bakracheva (2020) found that happiness primarily stems from intrinsic sources (e.g., love, joy), whereas life satisfaction is more strongly influenced by extrinsic factors (e.g., success, self-realization), alongside intrinsic ones. Flourishing is explained by those related constructs (i.e., happiness and life satisfaction) and reflects both intrinsic and extrinsic dimensions of well-being. Although life satisfaction, happiness, and flourishing are distinct constructs, they are closely interconnected components of positive psychological functioning that together offer a more comprehensive understanding of mental well-being (Clark & Senik, 2011; Huppert et al., 2013).

Previous research in the field of positive psychology has highlighted the importance of promoting these positive mental health indicators (Diener et al., 1999; Keyes, 2002; Seligman, 2011). For example, Howell, (2009) found that college students with higher levels of flourishing and happiness are more likely to report better academic performance, healthier interpersonal relationships, stronger intrinsic motivation, and lower dropout rates. Additionally, research indicates that students who experience positive emotions tend to be more resilient in the face of academic and personal stressors and are more likely to adopt more active stress-coping strategies, such as seeking social support and using constructive problem-solving behaviors (Fredrickson, 2001; Tugade & Fredrickson, 2004). These findings suggest that investigating positive psychological indicators can not only assess participants' health and well-being, but also help researchers, educators, and clinicians develop targeted interventions and programs that foster greater coping ability, optimism, and resilience. Ultimately, such efforts can enhance college students' long-term mental well-being, extending beyond the mere absence of mental illness.

Mindfulness-Based VR Programs to Promote Positive Psychological Well-Being Mindfulness-based VR program (MBVR) refers to a therapeutic program that applies mindfulness techniques within immersive virtual reality environments (Kim, Kim, & Ardon Lobos, 2025; Washburn et al., 2025). In this sense, unlike traditional mindfulness interventions simply deliver text or audio, MBVR provides more immersive and multisensory features of VR not only to enhance attentional focus but also to reduce distractions and to create a more engaging therapeutic experience. Mindfulness primarily involves one's focus of attention and cultivating a specific mindset in how one relates to personal experiences (Bishop et al., 2004). To achieve the two core components, MBVR programs focused on various interventions. Navarro-Haro et al. (2017), for example, utilized a breath-focused attention technique so the participants can focus on their physical sensations of the breath. Also, some MBVR programs goes beyond the sensations of the breath and observing any sensations move through different parts of the body, which is often called body scan (Arpaia et al. 2022). Other MBVR programs incorporates movements such as mindful walking or tai-chi movements to promote embodied awareness (Olasz et al., 2024).

Research has shown that mindfulness-based VR programs (MBVR) can help minimize environmental distractions by providing a more immersive and focused experience (Kosunen et al., 2016). Studies focusing on college students have found that mindfulness-based interventions delivered through VR are more effective in improving mental health outcomes compared to conventional

mindfulness programs (Bamber & Schneider, 2022; Modrego-Alarcón et al., 2021). For example, Cawley and Tejeiro (2024) compared a VR-based mindfulness intervention with an audio-based version. Using both self-administered questionnaires and physiological indicators such as heart rate, they found that the VR-based intervention led to greater stress reduction. Similarly, Modrego-Alarcón et al., (2021) found that integrating VR into mindfulness programs enhanced treatment adherence compared to non-VR versions.

Additionally, the immersive nature of VR enhances participants' engagement and facilitates positive emotional experiences (Puente-Torre et al., 2024). Previous studies have shown that participants often cite the novelty and ease of use as key reasons for preferring VR-based mindfulness over traditional methods (Ma et al., 2023). Moreover, research has reported high user satisfaction, low dropout rates, and a strong intension to repeat MBVR sessions among young adults, particularly college students (Modrego-Alarcón et al., 2021).

Purpose of the Present Study and Hypothesis

Our literature review suggests that MBVR interventions hold strong potential as innovative tools for promoting mental well-being among college students. Despite these promising findings, however, most research on MBVR interventions continues to emphasize symptom reduction, with relatively limited investigation into the participants' potential to enhance positive psychological outcomes such as life satisfaction, happiness, and flourishing. Therefore, the present study aimed to examine the effectiveness of an MBVR in enhancing positive psychological well-being by assessing changes in life satisfaction, happiness, and flourishing among college students following the intervention. Specifically, we tested the following hypothesis: College students who engage in the MBVR intervention will demonstrate significant improvements in life satisfaction, happiness, and flourishing following the program compared to pre-intervention levels.

Methods

Participants

A total of 19 participants were recruited from a college in eastern North Carolina, United States. To be eligible for the study, participants had to be at least 18 years old and able to verbally communicate and read English at an 8th-grade level. Individuals with a history of head injury, seizure activity, major mental disorders (e.g., schizophrenia or bipolar disorder), or prior experience with VR meditation were excluded from the study. A total of 45 individuals were invited to participate; 21 met the eligibility criteria and completed the informed consent process and 19 completed all study procedures. Participants ranged in age from 18 to 30 years, with a mean age of 20.09 years (*SD* = 3.1). The final sample included 7 males (36.8%) and 12 females (63.2%). All research procedures and protocols were approved by the Institutional Review Board(UMCIRB 22-002566).

Study Procedures

Recruitment of Participants. We recruited eligible participants from on-campus university residence halls. A research assistant obtained permission from the residence hall directors, after which informational flyers were posted in designated locations. Additional recruitment was conducted via email, which included a description of the study's purpose, consent forms, and information about the option to withdraw at any time. Interested individuals who responded to the flyer or email invitation were asked to complete a brief medical history questionnaire to assess eligibility. Potential participants were also recruited from Research Methods and Recreational Therapy courses. The research team contacted participants via email to provide the necessary materials and instructions. Participants who confirmed their interest were then scheduled for study participation through an online platform. In total, nineteen university students participated in eight sessions of MBVR.

Procedure. The MBVR was conducted using the Oculus Quest 2, a VR headset well known for its user-friendly, all-in-one design that offers a customizable and engaging virtual environment experience. A total of 19 college students completed the intervention, which consisted of eight 15-minute sessions delivered over the course of approximately one month. Participants typically engaged in two sessions per week for four consecutive weeks, though the exact time interval between T1 (pretest) and T2 (posttest) varied slightly depending on each participant's start date and scheduling availability. Survey instruments were administered at both time points, before the first session (T1) and immediately after the final session (T2). All MBVR sessions were conducted individually in a specialized virtual reality laboratory located at the sponsoring institution.

MVBR Program Content. This study utilized TRIPP (https://www.tripp.com), a commercially available VR application. TRIPP provides access to over 40 immersive meditation experiences, featuring aesthetically rich and abstract visual environments designed to reduce anxiety and promote psychological calmness. Users navigate surreal landscapes accompanied by mood-congruent music, which enhances the meditative experience. The platform also integrates gamified components that allow users to interact and reinforce various meditation techniques.

Measures

Demographic Factors. Demographic information, including participants' age and gender, was collected through the self-report survey.

Life Satisfaction. Life satisfaction was measured using five items from the Satisfaction with Life Scale (Diener, 1985). Sample items include "I am satisfied with my life" and "The conditions of my life are excellent." The scale demonstrated high internal consistency in this college student sample (Cronbach's $\alpha = .89$).

Happiness. Happiness was assessed using four items from the Subjective Happiness Scale (Lyubomirsky & Lepper, 1999). Example items include "In general, I am a happy person" and "I enjoy my life regardless of what is going on and try to get the most out of everything." This scale also showed high internal consistency (Cronbach's $\alpha = .92$).

Flourishing. Flourishing was measured using eight items from the Flourishing Scale (Diener et al., 2010). Example statements include "I lead a purposeful and meaningful life," "I am a good person and live a good life," and "I am optimistic about my future." This scale demonstrated strong reliability as well (Cronbach's $\alpha = .90$). All items assessing life satisfaction, happiness, and flourishing

were rated on the same 7-point Likert-type scale ranging from 1 (very strongly disagree) to 7 (very strongly agree).

Data Analysis

Descriptive statistical analysis was employed to summarize participants' perceived stress and anxiety levels (see Table 1). To evaluate the preliminary efficacy of the MBVR intervention, two-tailed paired t-test were performed to compare the pre- and post-intervention scores for both variables. Effect sizes were calculated using Cohen's d to further contextualize the magnitude of observed changes. All statistical procedures were executed using IBM SPSS Statistics version 29.

Results

Life Satisfaction

Descriptive statistics revealed a statistically significant improvement in life satisfaction following participation in the MBVR program. As shown in Table 1, mean life satisfaction scores increased from $M = 4.77$ (SD = 1.02) at pre-intervention to $M = 5.37$ ($SD = 1.03$) post-intervention. A paired-samples t-test confirmed that this mean increase of 0.51 was statistically significant, $t(18) = –3.21$, $p < .05$, SE = 0.19. The effect size was moderate, Cohen's $d = –0.74$; the negative sign reflects the direction of the computation (pre minus post), indicating an increase in life satisfaction. Further analysis showed that 84% of participants (16 out of 19) reported higher life satisfaction after the intervention, while only three participants reported a decrease. These findings provide both statistical and practical support for the effectiveness of the MBVR program in enhancing life satisfaction among college students.

Happiness

Participants showed a statistically significant improvement in happiness following the MBVR program. As shown in Table 1, mean happiness scores increased from $M = 4.95$ ($SD = 0.89$) at pre-intervention to $M = 5.38$ ($SD = 1.04$) post-intervention. A paired-samples t-test revealed that this mean increase of 0.43 was statistically significant, $t(18) = –2.51$, $p < .05$, $SE = 0.17$. The effect size was moderate, Cohen's $d = –0.58$, with the negative sign reflecting the direction of change (pre minus post), indicating a post-intervention increase in happiness. The change was consistent across participants, with 79% (15 out of 19) reporting higher happiness levels after the program. These results provide additional evidence supporting the efficacy of the MBVR intervention in promoting happiness among college students.

Flourishing

Participants also showed a statistically significant increase in flourishing following the MBVR program. As shown in Table 1, mean flourishing scores rose from $M = 5.55$ ($SD = 0.93$) at pre-intervention to $M = 5.92$ ($SD = 0.90$) post-intervention. A paired-samples t-test confirmed that this mean increase of 0.37 was statistically significant, $t(18) = –2.46$, $p < .01$, $SE = 0.15$. The effect size was moderate, Cohen's $d = –0.56$, where the negative sign reflects the computation direction (pre minus post), indicating a gain in flourishing. This improvement was consistent across participants, with 79% (15 out of 19) reporting higher flourishing levels after the intervention. These findings further support the effectiveness of the MBVR program in promoting flourishing among college students.

Discussion

This pilot study investigated the effectiveness of MBVR in enhancing life satisfaction, happiness, and flourishing among college students. Results demonstrated that participants experienced statistically significant improvements across all three domains of positive psychology following the intervention. These findings suggest that MBVR can serve as a proactive approach to cultivating positive psychological well-being in student populations. Given that previous studies have primarily focused on reducing symptoms such as anxiety and depression, the present study extends the body of knowledge by demonstrating that MBVR can also enhance positive psychological outcomes.

Our results add to a growing body of literature demonstrating the positive effects of VR-based programs on psychological well-being (Kim et al., 2020; Pavic et al., 2022). For example, Malighetti et al. (2023) found that nature-based VR programs significantly increased both emotional and psychological well-being (e.g., life satisfaction, positive affect, self-acceptance, and personal growth) among college students. The authors explained that the program's pleasant natural environments, combined with a relaxing narrative voice, allowed participants to focus on their feelings, thoughts, and bodily sensations in the present moment, which may have enhanced relaxation and emotional regulation. They also highlighted a synergetic integration of VR technology, mindfulness practices, and a restorative natural environment, which aligns with the features of the MBVR program implemented in the present study. Overall, these findings contribute to the growing body of literature supporting the integration of VR technology as an innovative approach to mindfulness practice for promoting mental health.

The findings of this study suggest several significant implications to both educators and practitioners. As many college students are vulnerable to mental distress due to academic pressures, identity development challenges, and broader societal stressors (Arria et al., 2013; Eisenberg et al., 2009; Paul et al., 2024), developing preventive and developmental interventions aimed at enhancing overall well-being is particularly critical for this population.

Table 1: Means with standard deviation (*SD*) and within-group comparisons for life satisfaction, happiness, and flourishing

	Pre		Post		Pre *vs.* Post			
					95% CI for Mean			
	Mean	SD	Mean	SD	Difference	*t*	*df*	*d*
Life Satisfaction	4.77	1.02	5.37	1.03	[-0.99, -0.21]	-3.21*	18	-0.74
Happiness	4.95	0.89	5.38	1.04	[-0.80, -0.07]	-2.51*	18	-0.58
Flourishing	5.55	0.93	5.92	0.90	[-0.68, -0.05]	-2.46**	18	-0.56

Note: *p<0.05, **p<0.01.t = t-statistic; df = degrees of freedom; d = Cohen's d (effect size; Pre-Post).

Traditional mindfulness programs such as Mindfulness-Based Stress Reduction (MBSR) and Mindfulness-Based Cognitive Therapy (MBCT) have consistently demonstrated positive outcomes, including reductions in anxiety and depression and improvements in subjective well-being (Gallego et al., 2014; Ritvo et al., 2021; Ștefan et al., 2018). These findings highlight the capacity of mindfulness practices to reduce not only negative mental states but also positive mental health attributes. Our study extends this body of knowledge by examining the preliminary health benefits of a VR technology-based mental health intervention.

Also, our research demonstrated the potential of MBVR as a promising option for delivering mental health services in a campus setting. VR technology has emerged as an innovative medium for delivering mindfulness interventions, offering an immersive and engaging platform that may enhance the effectiveness of traditional practices (Arpaia et al., 2022). Findings from previous studies support this point, indicating that participants often cite the novelty and ease of use as reasons for preferring VR-based mindfulness over traditional methods (Ma et al., 2023; Puente-Torre et al., 2024). In particular, studies involving young adults (e.g., college students) have reported high user satisfaction, low dropout rates, and a strong intention to repeat MBVR sessions (Modrego-Alarcón et al., 2021). These unique aspects of MBVR suggest that VR can serve as a valuable complement to conventional mindfulness practices, particularly in the context of promoting positive psychological outcomes.

Implications

The findings of this study have important implications for addressing the mental health needs of college students. As traditional campus mental health services struggle to meet growing demand, MBVR offers a scalable, accessible, and engaging alternative for promoting well-being. Universities might consider integrating MBVR sessions into campus wellness initiatives or including them in orientation programs to improve students' mental health and academic performance. Furthermore, given its brief duration (10 minutes per session) and ease of delivery, the MBVR program may serve as a practical and approachable mental health tool, especially for non-clinical populations (e.g., students experiencing moderate distress) or those reluctant to seek conventional mental health support. Previous studies support this potential, suggesting that even short VR mindfulness interventions are effective in reducing stress and improving mood in students, while also maintaining high user acceptability (Puente-Torre et al., 2024).

From a practical standpoint, virtual environments can be customized based on participants' emotional states or therapeutic goals, such as selecting calming nature scenes or more structured spaces to maximize engagement and effectiveness across various settings. Educators and facilitators should also consider technological and ergonomic factors, including the proper fit of VR headsets and controller sensitivity. A lightweight and adjustable tightness of headset may reduce discomfort or nausea, potentially increase the effectiveness of the session. Additionally, instructors can use the casting function to project the participant's view onto an external screen. This allows group members to observe the meditation session in real time, fostering shared discussion and reflection. Encouraging students to express their thoughts and feelings during or after the session can further enhance self-awareness and peer learning, supporting an open dialogue about mental well-being.

In this study, 45 students initially expressed interest; however, only 21 students enrolled, and 2 participants dropped out during the study period. We believe that conflicting schedules and perceived time constraints were key barriers for this student population. Therefore, effective strategies are needed to increase the final sample size without losing interested potential participants. For example, future recruitment efforts could include making announcements in large-enrollment general education courses, allowing session completion at multiple campus sites (e.g., wellness centers, recreation centers, or residence hall study rooms), and offering non-monetary incentives aligned with wellness goals (e.g., free recreation passes, fitness class vouchers, or university-branded items).

Study Limitations and Future Research

Despite the promising findings, several limitations should be acknowledged. First, the small sample size (n = 19) limits the generalizability of the results. Future research should include larger and more diverse samples to validate and extend these findings. Second, as a pilot study, the lack of a control group prevents causal inferences about the intervention's effectiveness; it remains unclear whether the observed improvements were solely attributable to the MBVR intervention or influenced by other factors. Randomized controlled trials (RCTs) are needed to isolate the specific effects of MBVR.

Additionally, future research should account for potential confounding factors such as sex, race, cultural background, and baseline mental health status to more accurately evaluate the efficacy of MBVR. Third, this study relied exclusively on self-reported measures, which may be subject to response biases such as social desirability or expectancy effects. Incorporating objective physiological indicators (e.g., heart rate variability [HRV], electroencephalography [EEG]) in future research could help validate and strengthen the current findings. Finally, post-intervention follow-up measures are recommended to evaluate the long-term effects of MBVR interventions and to determine whether the positive outcomes observed in the present study are maintained over time.

Conclusion

This study found that MBVR significantly improves life satisfaction, happiness, and flourishing. While much of the existing research has focused on interventions for reducing negative psychological states such as stress, anxiety, and depression, this study shifts the focus toward enhancing positive psychological determinants, including life satisfaction, happiness, and flourishing. The findings suggest that MBVR holds promise as a proactive and engaging tool for promoting mental well-being in non-clinical, preventive settings such as college campuses. Future research should use larger, more diverse samples to strengthen the generalizability of the findings. Randomized controlled trials and physiological outcome measures can offer a clearer understanding of the intervention's long-term impact and underlying mechanisms. .

Compliance with Ethical Standards

Disclosure of Potential Conflicts of Interest. The authors declare no conflicts of interest related to the research, authorship and/or publication of this article.

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Ethical Approval. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethical approval was obtained from the Institutional Review Board of East Carolina University (UMCIRB 22-002566).

Informed Consent. Consent was obtained from all participants included in the study.

Data Sharing Statement. The data file for this study is available upon request.

Author Contributions. Jaehyun Kim conceptualized and designed the pilot study, oversaw project administration, and contributed to the methodology, data analysis, and preparation of the original manuscript draft. Yongseop Kim assisted with study design, data management, and provided critical review and revisions of the manuscript. Chungsup Lee contributed to the statistical analysis and participated in manuscript editing.

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