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Effect of Web-Based Psychoeducation on Depression, Anxiety, and Stress Among End-Stage Renal Disease Patients Undergoing Hemodialysis: A Prospective Pre-Post Study

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ABSTRACT

Background: Patients with end-stage renal disease (ESRD) undergoing maintenance hemodialysis experience substantial psychological distress, specifically depression, anxiety, and stress. Conventional face-to-face and printed health education are widely used; digital health platforms offer enhanced accessibility and interactive engagement.
Purpose: To examine the effectiveness of web-based psychoeducational intervention among ESRD patients undergoing maintenance hemodialysis.
Methods: A prospective pre-post study design was applied. A total of 60 participants completed the study. The intervention group accessed a web module (15–30 minutes, twice weekly for 8 weeks), the control group received condensed printed booklets. Depression, anxiety, and stress were measured using the validated Indonesian version of the Depression Anxiety Stress Scales (DASS-42). Within-group changes were analyzed using the Wilcoxon signed-rank test, and between-group treatment effects were evaluated using the Mann-Whitney U test.
Results: Both groups demonstrated statistically significant within-group reductions in depression, anxiety, and stress scores. However, between-group comparisons revealed that the web-based intervention yielded significantly lower post-treatment scores than the printed control group across all three domains: depression (Mean 2.13 ± 3.48 vs. 8.60 ± 4.12; $p < 0.001$, $r = 0.68$), anxiety (Mean 4.80 ± 3.92 vs. 15.30 ± 5.21; $p < 0.001$, $r = 0.74$), and stress (Mean 3.20 ± 3.10 vs. 14.10 ± 4.85; $p < 0.001$, $r = 0.71$).
Conclusion: Although both delivery formats contributed to psychological relief, web-based psychoeducation achieved superior efficacy in reducing depression, anxiety, and stress. Interactive digital health platforms represent a highly effective complementary model of care in nephrology nursing.

Keywords **:** Anxiety; Depression; Digital Health; Hemodialysis; Nephrology Nursing; Stress; Web-Based Psychoeducation.

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BACKGROUND

Globally, chronic kidney disease (CKD) represents a major public health challenge, with mortality projected to increase by approximately 14% by the year 2030 (World Health Organization, 2018). In Indonesia, data from the Indonesian Renal Registry indicated a 7% increase in end-stage renal disease (ESRD) incidence over the past decade, with 52% of affected individuals belonging to the economically productive age group (25–54 years) (Indonesa Renal Registry, 2019; Puspitasari et al., 2024). In 2018, there were 132,142 patients who received maintenance hemodialysis in Indonesia, with over 50% classified as newly diagnosed ESRD cases initiating renal replacement therapy (Indonesia Renal Registry, 2019).

End-stage renal disease (ESRD) represents a critical global health burden requiring long-term renal replacement therapy, most commonly maintenance hemodialysis. The diagnosis and long-term regimen of hemodialysis impose an immense physical, social, and psychological burden on patients (Akyuni et al., 2026). Accumulated empirical evidence highlights that psychoeducation serves as a vital intervention designed to empower patients with coping strategies, disease management knowledge, and emotional regulation techniques (Nihayati et al., 2020; Suarilah et al., 2023). Depression (Al-Jabi et al., 2021), anxiety (Pandey et al., 2025), and general distress (Combes et al., 2019) are the most prevalent psychological comorbidities in hemodialysis units. These psychological factors impair treatment adherence, exacerbate interdialytic weight gain, deteriorate health-related quality of life, and elevate hospitalization and mortality rates.

Until recently, conventional face-to-face interventions to manage depression, anxiety, and stress have been widely applied among hemodialysis patients (Chang & Kim, 2026). Later, internet-based health programs gained popularity and were claimed to effectively empower CKD patients (Xu et al., 2025). Thus, a recent review on the usability of electronic health information reported growing evidence that CKD web pages have benefited patients undergoing hemodialysis; the effect of telehealth programs has been widely examined to manage clinical characteristics such as interdialytic weight gain, blood chemistry and length of hospitalizations (Suarilah et al., 2023). A recent study exploring the feasibility, acceptability, and preliminary effects of conventional psycho-educational intervention for patients on hemodialysis and their family caregivers (Sousa et al., 2021) reported the effectiveness of intervention on psychological well-being patients. Critical systematic reviews have noted inconsistent findings regarding whether digital interventions offer superior psychological relief compared to traditional printed educational tools (Zhang et al., 2024). However, less study was found on determining the effect of web-based psycho-education intervention on the psychological well-being of hemodialysis patients.

The rapid growth of digital health technologies offers promising opportunities to deliver interactive, accessible, and self-paced psychoeducational content (Mumtaz et al., 2023). In the context of the Indonesian healthcare setting, the imperative for remote health education was further heightened by the COVID-19 pandemic, which restricted face-to-face interactions and necessitated innovative telehealth care delivery. In response, the Indonesian Dialysis Nurses Association (IPDI) East Java developed an interactive web-based psychoeducational platform specifically tailored for hemodialysis patients. Therefore, this

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study aimed to examine the effectiveness of web-based psychoeducational intervention compared with condensed printed psychoeducation in reducing depression, anxiety, and stress among ESRD patients undergoing maintenance hemodialysis.

METHODS

Design and Setting

A prospective pre-post study design (quasi-experimental non-randomised comparative trial) was applied. The study was conducted at the hemodialysis unit of an urban tertiary referral hospital in Surabaya, East Java, Indonesia. Offline recruitment was conducted during routine hemodialysis shifts.

Participants and Sample Size Determination

Eligible participants met the following criteria: (a) adult ESRD patients aged ≥18 years undergoing maintenance hemodialysis; (b) ability to read and comprehend Indonesian; (c) ownership and active use of a smartphone with internet access; and (d) absence of acute crisis or active psychiatric decompensation. Exclusion criteria included: (a) acute kidney injury; (b) cognitive impairment or dementia preventing comprehension; and (c) a documented clinical history of severe psychiatric illness. Sample size determination was based on the standard formula for comparing two continuous group means in a two-tailed hypothesis test (Polit & Beck, 2020).

$$n = \frac{2 \cdot (Z_{\alpha/2} + Z_{\beta})^2 \cdot \sigma^2}{\Delta^2} = \frac{2 \cdot (Z_{\alpha/2} + Z_{\beta})^2}{d^2}$$

Assuming a two-tailed significance level α = 0.05 (Z {0.025} = 1.96), statistical power 1 - β = 0.80 (Z_{0.20} = 0.84), and an expected medium-to-large effect size (Cohen's d = 0.75) based on prior psychoeducational literature, a minimum sample size of 28 participants per group was required. Considering a moderate effect size (Cohen, 1992), a minimum of 30 participants per group (N = 60 total) was required (Figure1).

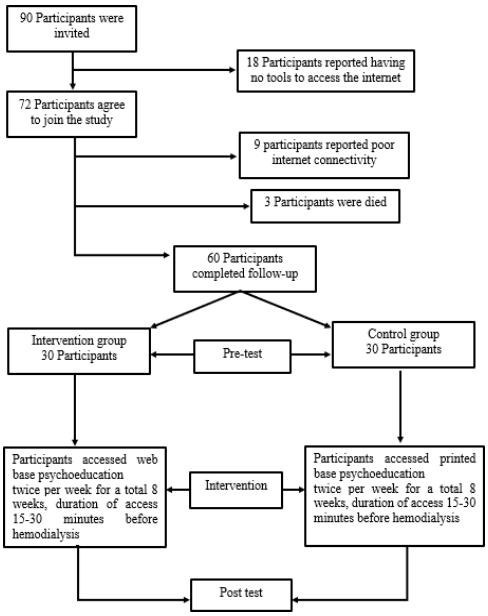


Figure 1. Flowchart of study participants

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A total of 90 participants were invited. Of them, 29 were excluded for the following reasons: 18 were reported to have no tools to access the internet and were not interested in joining the study. Nine participants who experienced intermittent network connectivity were provided technical and access support; however, they were excluded from the final analysis to prevent potential intervention exposure bias. Three were non-completers (due to medical mortality unrelated to the study). Finally, a total of 60 participants (30 in the web-based intervention group and 30 in the printed control group) completed the full 8-week protocol and were included in the final analysis.

Intervention Procedures and Comparability

The web-based psychoeducational intervention utilized an official online portal developed by the Indonesian Dialysis Nurses Association East Java that can be accessed from the following link: 'https://ipdijatim.org/pasienhemodialisis/. The platform comprises 67 interactive PowerPoint-based learning modules addressing renal disease physiology, fluid and dietary management, coping mechanisms for emotional distress, relaxation exercises, and family support strategies. Participants in the intervention group engaged with the platform for 15–30 minutes per session, twice weekly during their 4-hour hemodialysis shifts, over 8 weeks (totaling 16 sessions). Dialysis nurses facilitated initial onboarding, simulation, and weekly technical navigation.

To ensure content comparability, the control group received a condensed printed booklet containing identical educational text, visual diagrams, and guidelines extracted directly from the web portal (Figure 2). Control participants reviewed the booklet independently at the clinic and at home over the same 8-week duration with standard nursing care.

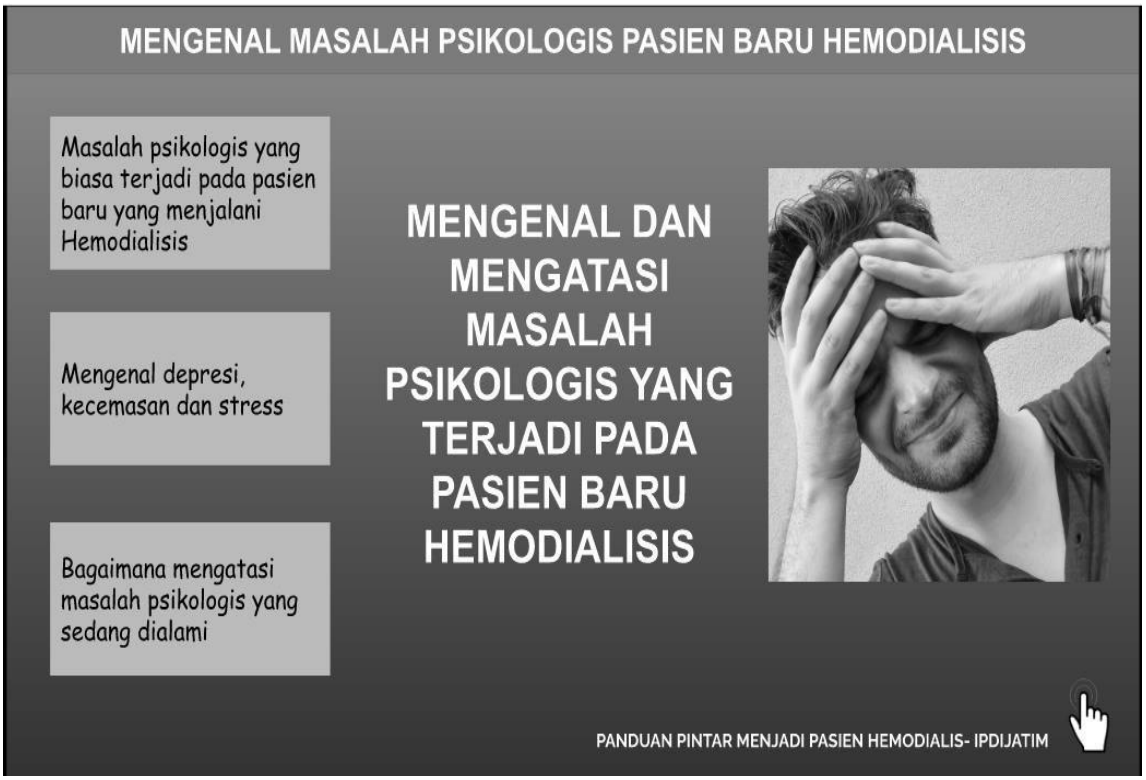


Figure 2. Content of Web-based psychoeducation
(Source: https://ipdijatim.org/pasienhemodialisis/)

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Measurement Instruments

Demographic and clinical data (age, gender, marital status, employment, dialysis tenure, and primary ESRD etiology) were collected at baseline using a structured questionnaire. Psychological distress was evaluated using the Indonesian version of the Depression Anxiety Stress Scales (DASS-42) (Lovibond & Lovibond, 1995). The Indonesian version of DASS-42 (Widyana & Sumiharso, 2020) contains 42 items divided into three 14-item subscales: Depression, Anxiety, and Stress. Each item is rated on a 4-point Likert scale (0 = did not apply to me at all; 3 = applied to me very much or most of the time). Subscale scores range from 0 to 42, with lower scores indicating greater psychological well-being.

Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics version 25.0. Data distribution was examined using the Shapiro-Wilk test, which confirmed non-normal distribution for continuous DASS-42 scores across both groups ($p < 0.05$). Consequently, non-parametric statistical methods were employed. Descriptive data are presented as frequencies, percentages, and Mean ± Standard Deviation (SD).

Within-group pre-to-post changes in DASS-42 scores were evaluated using the Wilcoxon signed-rank test. Between-group treatment effects (comparing web-based vs. printed groups at baseline and 8-week post-intervention) were evaluated using the Mann-Whitney U test. Non-parametric between-group effect sizes were calculated as $r = Z / \sqrt{N}$, where values of 0.10, 0.30, and 0.50 correspond to small, medium, and large effect sizes, respectively (Cohen et al., 2013). The level of statistical significance was set at $p < 0.001$.

Ethical Considerations

Ethical approval was granted by the Ethics Committee of Hajj General Hospital Surabaya, Indonesia (Approval No: 073/01/KOM.ETIK/2021). All participants provided written informed consent. Re-evaluation in 2026 confirmed the continued ethical and practical relevance of these findings for post-pandemic digital nephrology nursing care.

RESULTS

Participant Characteristics

A total of 60 ESRD patients completed the study protocol. As detailed in Table 1, baseline demographic and clinical characteristics were balanced between the web-based treatment group (n = 30; mean age 48.80 ± 12.94 years) and the printed control group (n = 30; mean age 47.60 ± 9.53 years). Males comprised 46.7% of the treatment group and 56.7% of the control group. Unemployed individuals and housewives represented over 70% of participants. Dialysis tenure exceeded one year in 66.7% of the intervention group and 53.3% of the control group. The primary etiologies of ESRD were diabetic nephropathy (43.3% treatment, 40.0% control) and hypertensive nephrosclerosis (36.7% treatment, 26.7% control).

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Table 1. Sociodemographic and Clinical Characteristics of Participants (N = 60)

Participants' Characteristics	Treatment (n=30)		Control (n=30)	
	N	%	N	%
Age (Years) Mean ± SD	48.80± 12.94		47.60 ± 9.53	
Gender				
Male	14	46.7	17	56.7
Female	16	53.3	13	43.3
Employment				
Civil-servant/government employee	2	6.7	3	10
Housewife	10	33.3	9	30
Private	3	10	5	16.7
Self-employee	3	10	3	10
Unemployment	12	40	10	33.3
Marriage				
Married	21	70	25	83.3
Divorce/widow	4	13.3	1	3.3
Not married yet	5	16.7	4	13.3
Length of hemodialysis				
0- 6 months	7	23.3	7	23.3
>6 months- 12 months	3	10	7	23.3
>1 year – 5 year	12	40	10	33.3
>5 years	8	26.7	6	20
Etiology of end-stage renal diseases				
• Diabetes mellitus	13	43.3	12	40
• Hypertension	11	36.7	8	26.7
• Uric acid	2	6.7	4	13.3
• Nephrolithiasis	1	3.3	3	10
• Renal infection	2	6.7	0	0
• Autoimmune	1	3.3	3	10

Considering Table 1, demographic characteristics of study participants and clinical variables showed no statistically significant baseline differences between the treatment and control groups ($p > 0.05$ across all parameters), confirming rigorous baseline comparability for this prospective pre-post study design

Effects of Psychoeducation on Psychological Distress

Table 2 outlines the pre- and post-intervention continuous DASS-42 scores, within-group Wilcoxon signed-rank comparisons, and between-group Mann-Whitney U test results.

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Table 2. Comparison of Continuous DASS-42 scores Pre- and Post-Intervention Between Groups (N = 60)

DASS-42 Domain	Timepoint	Treatment (n=30) Mean ± SD	Control (n=30) Mean ± SD	Wilcoxon p (Treatment)	Wilcoxon p (Control)	Mann-Whitney U Post p (Effect Size r)
Depression	Pre-Intervention	13.80 ± 2.10	13.60 ± 2.25	-	-	p = 0.782
Depression	Post-Intervention	2.13 ± 3.48	8.60 ± 4.12	p < 0.001	p = 0.014	p < 0.001 (r = 0.68)
Anxiety	Pre-Intervention	21.40 ± 3.80	20.90 ± 4.10	-	-	p = 0.624
Anxiety	Post-Intervention	4.80 ± 3.92	15.30 ± 5.21	p < 0.001	p = 0.017	p < 0.001 (r = 0.74)
Stress	Pre-Intervention	19.50 ± 3.20	18.90 ± 3.50	-	-	p = 0.518
Stress	Post-Intervention	3.20 ± 3.10	14.10 ± 4.85	p < 0.001	p = 0.037	p < 0.001 (r = 0.71)

At baseline, no statistically significant differences were observed between groups across depression ($p = 0.782$), anxiety ($p = 0.624$), or stress scores ($p = 0.518$). Following 8 weeks of intervention, both groups demonstrated statistically significant within-group reductions in all three subscale scores (Wilcoxon $p < 0.05$). Between-group comparisons using the Mann-Whitney U test established that the web-based intervention group achieved significantly lower post-intervention scores compared to the printed control group for depression ($p < 0.001$, $r = 0.68$), anxiety ($p < 0.001$, $r = 0.74$), and stress ($p < 0.001$, $r = 0.71$), reflecting large intervention effect sizes ($r > 0.50$).

DISCUSSION

This prospective pre–post study evaluated the effectiveness of a nurse-led web-based psychoeducational intervention compared with condensed printed educational materials in reducing psychological distress among patients undergoing hemodialysis. The findings demonstrated statistically significant within-group reductions in depression, anxiety, and stress in both intervention groups.

The web-based intervention demonstrated substantially greater between-group effects, with large effect sizes suggesting superior efficacy in alleviating psychological distress compared with printed materials. These results align with recent systematic reviews emphasizing that structured digital health interventions offer enhanced engagement compared to static media (Zhang et al., 2024). In the current study, the 67-page interactive web module provided rich visual illustrations, self-paced navigation, and multimedia content regarding fluid restriction, dietary adherence, and coping strategies. Furthermore, active nursing facilitation during hemodialysis sessions reinforced learning and participant motivation. Similar digital health trials in chronic renal care have documented that interactive web platforms significantly

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enhance self-efficacy and emotional regulation (Xu et al., 2025). These findings underscore that digital psychoeducational platforms should not be implemented as unassisted, standalone self-help tools. Instead, their clinical utility is maximized through a blended care framework in which dialysis nurses serve as active facilitators during routine treatments.

Considering psychological well-being outcomes, anxiety emerged as the most severe psychological distress domain at baseline. Although anxiety scores decreased significantly in the web-based group, residual mild-to-moderate anxiety persisted in a subset of participants. This finding corroborates prior psychoeducational studies reporting that anxiety in maintenance dialysis patients is deeply rooted in fears of somatic complications, vascular access failure, and mortality (Marin et al., 2026). Thus, while informational psychoeducation effectively alleviates disease-related uncertainty, specialized cognitive-behavioral techniques and professional counseling may be required to resolve persistent somatic anxiety (Espahbodi et al., 2015; Shokrpour et al., 2021; Sohn et al., 2018). These findings highlight the persistence of residual mild-to-moderate anxiety despite significant improvements post-intervention, emphasizing the need for a mental health protocol within routine nephrology care. While digital informational psychoeducation serves as an effective, low-threshold intervention for managing general disease uncertainty and mild distress, patients presenting with moderate-to-severe or persistent somatic anxiety require seamless stepped escalation to targeted therapies.

In comparison to participants who received web-based psychoeducation, participants in the printed control group demonstrated significantly more modest reductions in psychological distress. The condensed booklet format, while accessible, lacked the dynamic simulation, nursing interaction, and modular structure of the web portal. This finding highlights that media format and delivery intensity play crucial roles in psychological education outcomes (Acar et al., 2026). Although the condensed booklet format offers high accessibility and a low technical barrier, its static, non-interactive nature inherently limits cognitive engagement and deep information processing. Unlike the web portal (Suarilah et al., 2023), which provided self-paced modular learning, dynamic simulations, and structured nursing facilitation, static print materials (Musabirema et al., 2026) rely primarily on passive reading without real-time feedback or iterative reinforcement loops. Consequently, while conventional print education remains a useful baseline resource, its capacity to cultivate self-efficacy and sustained emotional self-regulation is constrained. These observations underscore that media architecture, structural design, and delivery intensity serve as pivotal determinants of patient health literacy, active learning, and psychological adjustment in chronic renal care.

Limitations

Several methodological limitations must be acknowledged. First, the non-randomized prospective pre-post design introduces potential selection bias, although baseline demographic and clinical characteristics were balanced between groups. Second, the single-center setting in urban Surabaya limits the generalizability of findings to rural dialysis clinics with lower digital infrastructure. Third, double-blinding was unfeasible due to the nature of the educational media. Fourth, participant eligibility required smartphone ownership and internet connectivity, potentially excluding older or socioeconomically disadvantaged patients. Finally, the 8-week

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evaluation period precluded assessment of long-term psychological maintenance beyond two months.

Implications for Nursing Practice

The findings underline important implications for nephrology nursing practice. Web-based psychoeducation can be seamlessly integrated into routine 4-hour hemodialysis sessions, transforming passive treatment time into productive self-management education. Dialysis nurses play a crucial role as digital health navigators, identifying patients experiencing severe anxiety or depression for timely referral to clinical psychologists. Interprofessional collaboration between nephrologists, dialysis nurses, and information and technology (IT) developers is essential to refine user-friendly digital platforms for chronic disease management. Future multi-centre studies with extended follow-up periods are recommended to evaluate the long-term clinical and psychological sustainability of digital psychoeducation.

CONCLUSION

This study demonstrates that anxiety emerged as the most severe psychological distress domain among patients undergoing maintenance hemodialysis. An 8-week, 15–30 minutes, twice-weekly web-based psychoeducational intervention significantly reduced depression, anxiety, and stress among ESRD patients undergoing maintenance hemodialysis. While both web-based and printed interventions yielded within-group improvements, the interactive web platform demonstrated superior treatment efficacy compared to static printed booklets, particularly in addressing anxiety. By integrating self-paced learning with active nursing reinforcement, digital health platforms provide a scalable, engaging, and effective complementary care model in nephrology nursing, particularly for patients facing physical limitations or geographical constraints.

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AUTHOR CONTRIBUTIONS

Ira Suarilah: Conceptualization, Methodology, writing – original draft, Writing – review & editing. **Abu Bakar**: Methodology, Validation. **Rini Purwanti**: Investigation, Resources, Data curation. **Supriyono Supriyono**: Investigation, Resources, Data curation. **Nguyen Van Giang**: Validation, Supervision, Writing – review & editing. All authors reviewed and approved the final version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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DECLARATION OF AI USE

A generative artificial intelligence (AI) tool,' Gemini', was used to assist with language editing, grammar checking, and improving the clarity and readability of the manuscript. The authors reviewed and critically evaluated all AI-assisted revisions and take full responsibility for the accuracy, integrity, originality, and final content of the manuscript. AI tools were not used to generate research data, conduct statistical analyses, or interpret the study findings

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