

Effectiveness of BHATIN (Behavior-Tailored Intervention) for Self-Care Management and Clinical Biomarkers Among Patients with Hypertension: A Quasi-Experimental Study [Letter]

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Dear editor

We read with interest the article by Usman et al, which evaluated the BHATIN model for improving self-care management and clinical biomarkers among adults with hypertension.¹ The topic is clinically important because sustainable behavioral support is central to community hypertension care. Our main reason for responding is to highlight several methodological and analytical limitations that may compromise internal validity and lead to overestimation of the intervention effect. We also offer practical suggestions that may strengthen interpretation of the findings and guide future evaluations of similar nurse-led interventions.

The first concern relates to the unit of allocation. Participants were recruited from two different villages, with one village designated as the intervention site and the other as the control site.¹ This means that treatment assignment was completely confounded with village. Therefore, observed post-intervention differences may reflect the BHATIN intervention, pre-existing village-level differences, or both. This concern is not only theoretical. As reported in Table 2 by Usman et al, there were statistically significant baseline differences in weight, height, total cholesterol, uric acid, and salt preference, and large numerical differences in attitude, subjective norm, and behavioral intention.¹ These imbalances could plausibly reflect differences in village-level health behaviors, habitual diet and salt exposure, medication-use patterns, community health-worker engagement, or routine primary-care implementation before the intervention began. Guidance for cluster trials has emphasized that studies with one cluster per arm should be avoided because the intervention effect cannot be validly separated from the cluster effect.² At minimum, this limitation should be stated more explicitly and causal language should be softened. Future evaluations could use individual randomization within villages when contamination is manageable, or multiple villages per arm, a cluster-randomized design, or a stepped-wedge approach when contamination is a major concern.

A second issue concerns baseline comparability and the analytical strategy used to estimate treatment effects. The paper states that the groups were generally comparable at baseline, yet several variables differed materially.¹ In nonrandomized studies, reliance on baseline significance testing to establish comparability is problematic because it may obscure clinically relevant imbalance and may misguide confounder handling.³ More importantly, the authors analyzed within-group change using paired t-tests and post-intervention between-group differences using independent t-tests.¹ For pre-post comparative studies, this approach is weaker than regression-based analyses that adjust for baseline

values and prespecified covariates.^{4,5} In the present study, adjusted models would be particularly important because allocation was nonrandom and several baseline variables differed. A more informative analysis would report adjusted between-group mean differences with 95% confidence intervals, using baseline outcome values and clinically relevant covariates as adjustment variables. If cluster allocation is retained, the analysis should also acknowledge the village-level structure, even if the very small number of clusters limits formal cluster adjustment.

A third issue concerns outcome multiplicity and interpretation across domains. The study assessed numerous psychosocial, behavioral, anthropometric, blood pressure, and metabolic endpoints, but the statistical section does not clearly identify a primary endpoint or a multiplicity strategy.¹ When many hypotheses are tested at the conventional 0.05 threshold, the probability of at least some false-positive findings increases.⁶ This is important because the discussion presents broad effectiveness across psychosocial mechanisms, salt preference, blood pressure, and cardiometabolic biomarkers. A clearer hierarchy of outcomes would help readers distinguish confirmatory findings from exploratory signals. For example, the authors could prespecify one or two primary outcomes, report secondary outcomes as exploratory, and consider multiplicity adjustment or cautious interpretation across outcome families.

Relatedly, the internal consistency of the salt preference results requires clarification. Table 5 in Usman et al reports the post-intervention salt preference in the intervention group as 0.097, whereas Table 6 reports the corresponding post-intervention value as 0.972.¹ Because salt preference is presented as a key behavioral mechanism linking psychosocial change to clinical improvement, a typographical or decimal-place error could materially alter the interpretation of one of the study's central claims. Clarifying the correct value, units, and calculation method would improve transparency and help readers assess the magnitude and clinical relevance of this outcome.

These methodological concerns have clinical implications. The BHATIN model may be a promising community-based intervention, and even modest improvements in blood pressure and self-care could be valuable if sustained. However, clinicians, nurses, and policy-makers need to know whether the observed effects are attributable to the intervention rather than to baseline village differences, secular trends, or analytic choices. Reanalyzing outcomes with baseline-adjusted models, resolving the salt preference inconsistency, and presenting multiplicity-aware interpretations would substantially strengthen confidence in the findings. Until then, the reported benefits should be interpreted as promising but not definitively causal evidence of intervention effectiveness.

Declaration of Generative Artificial Intelligence

During the preparation of this manuscript, the authors used Grammarly and Paperpal solely to improve grammar, clarity, and language expression. These tools were used only for language editing and did not influence the scientific content, interpretation, or conclusions of the manuscript. The authors take full responsibility for the content of this publication.

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