

Methodological Considerations in AIoT-Based Stroke Rehabilitation Research [Letter]

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Dear editor

We read with interest the study by Lv et al investigating AIoT-based wearable devices for stroke walking rehabilitation.¹ While we appreciate the authors' innovative approach, several methodological limitations warrant discussion to advance evidence-based implementation of wearable technology in stroke rehabilitation.

The substantial group imbalance (106 AIoT vs 671 control patients) represents a fundamental design flaw that undermines validity despite propensity score matching. This 6.3:1 ratio raises serious concerns about selection bias and external validity that cannot be adequately addressed through post-hoc statistical adjustments. Boukhenoufa et al² specifically emphasized that such unequal sample sizes in rehabilitation technology studies introduce systematic biases that limit robustness of conclusions and hinder clinical translation.

The complete absence of cost-effectiveness analysis represents a critical limitation for clinical translation. Contemporary health technology assessment requires comprehensive economic evaluation considering direct costs, indirect costs, and opportunity costs. Boukhenoufa et al² emphasized that rehabilitation technology research must supplement effectiveness studies with economic assessment to guide resource allocation decisions. Without economic evaluation, the study provides insufficient guidance for healthcare decision-makers and policymakers considering technology adoption.

The single-center design and one-month follow-up period fundamentally limit assessment of long-term effectiveness and multicenter reproducibility. Systematic reviews consistently show that wearable sensor studies suffer from these temporal and geographical limitations, creating evidence gaps that hinder comprehensive implementation guidelines.² The abbreviated timeline prevents assessment of sustained benefits and technology adherence—critical factors for clinical implementation decisions.

The control group description as “routine rehabilitation training” without detailed standardization protocols prevents clear attribution of benefits to specific AIoT technology versus general increased attention and training intensity. Demers et al³ emphasized that standardized training protocols are essential to avoid attention bias in technology-assisted rehabilitation studies. This confounding makes it impossible to determine whether improvements result from specific AIoT features or enhanced overall rehabilitation engagement.

The authors inadequately address digital divide implications for real-world implementation. Gebreheat et al⁴ demonstrated that successful digital rehabilitation requires consideration of technological literacy, support systems, and infrastructure adequacy—factors that could significantly influence reported effectiveness outcomes.

While this study contributes preliminary evidence for AIoT-based stroke rehabilitation, the methodological limitations significantly constrain generalizability and clinical translation potential. Future research requires adequately powered balanced randomized controlled trials with comprehensive economic evaluation, multicenter designs, extended follow-up periods, and attention-matched control groups to establish robust evidence that meaningfully informs clinical practice and policy decisions.

Disclosure

The authors report no conflicts of interest in this communication.

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