

Evaluation of Sample Size Calculation and Statistical Analysis in PM&R Research Articles

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Objective

This work assesses the adequacy of sample size calculation and statistical analysis reporting in recent research articles in major physical medicine and rehabilitation journals.

Design

A methodological review was conducted on research articles published in five representative journals. Two experienced reviewers independently evaluated each study using predefined criteria to assess the sample size calculations, assumption checking, reporting transparency, and appropriateness of the statistical analyses.

Results

This work evaluates 38 articles. Only 9 of 34 assessable articles (26.5%) described an appropriate sample-size calculation, including defining the primary endpoint, justifying the effect size, and providing statistical parameters. Three articles (8.8%) reported the test type (one- or two-sided), and five articles (14.7%) indicated the statistical software for the sample-size estimation. Conversely, all studies (100%) applied appropriate statistical methods, and 83.8% of the assessed studies reported the statistical software. However, only 12 of the 33 applicable articles (36.4%) reported checking the statistical assumptions, including the normality for parametric tests (46.2%) and regression assumptions (18.8%).

Conclusions

While statistical methods were generally appropriate, reporting of sample size justification and assumption-checking procedures was insufficient. Enhancing transparency by reporting effect size justification, test type, and assumption checks improves research rigor.

Article title	Statistical method
American Journal of Physical Medicine & Rehabilitation	
"Assessment of Interrater Reliability for Interpretation of Musculoskeletal Ultrasound Imaging of the Quadriceps Femoris"	Intraclass correlation coefficient
"Concussion Reporting Is Critical for Football Players Surveyed for Short-Term Management and Lifelong Functioning"	Logistic regression analysis
"Effect of Wearable Robot-Assisted Gait Training on Balance and Walking Ability in Subacute Stroke Patients"	Repeated-measure ANOVA
"Measuring the Efficacy of Percutaneous Cryoneurolysis in Participants with Refractory or Plateaued Shoulder, Elbow, Wrist, or Finger Spasticity"	Wilcoxon signed-rank test, paired t-test, linear regression analysis
"Obstructive Sleep Apnea and Risk of Cardiovascular Events or All-Cause Mortality in Patients with Spinal Cord Injuries"	Student t-test, chi-square test, logistic regression analysis, Kaplan-Meier survival analysis, log-rank test
"Acute Effect of Lower Body Positive Pressure Treadmill Walking in Individuals with Knee Osteoarthritis: A Pilot Study"	Paired t-test, chi-square test
"Promoting Early Aerobic Exercise Initiation After Concussion: A Pilot Study Examining How Prescription Method Can Influence Recovery in a Non-Athlete, Adult Population Result From the Toronto Concussion Study"	Kruskal-Wallis test, Fisher's exact test, independent t-test, Kaplan-Meier survival analysis, log-rank test
"Shear-Wave Elastography Supports That Muscle Stiffness Should Not Be Considered a Criterion to Determine the Presence of Myofascial Trigger Points in the Infraspinatus Muscle"	Paired t-test, independent t-test, Pearson correlation analysis, intraclass correlation coefficient
Archives of Physical Medicine and Rehabilitation	
"Opioid and Benzodiazepine Use in a Population-Based Cohort of Adults with Chronic Spinal Cord Injury: Correspondence Between Self-Report and State Prescription Monitoring Data"	Independent t-test, chi-square test
"Evaluating Racial Disparities in Food Access and Their Influence on Body Mass Index in Individuals with Traumatic Spinal Cord Injury"	Chi-square test, ANOVA, logistic regression analysis
"Behavioral Fluctuation in Disorders of Consciousness: A Retrospective Analysis"	Chi-square test
"Predictors of Response to Cognitive Behavioral Therapy for Sleep Disturbance and Fatigue After Acquired Brain Injury: A Secondary Analysis of a Randomized Controlled Trial"	Independent t-test, chi-square test, linear regression analysis
"Echoes of the Battlefield: Five-Year Longitudinal Cognitive Trajectories Exhibit a Trend of Recovery for Deployment-Related Mild TBI in the IMBIC-C2NC Cohort"	Multilevel linear mixed-effects modeling
"Association of Patient Characteristics with Recovery in Adults with Disorders of Consciousness"	Fisher's exact test, Wilcoxon signed-rank test, logistic regression analysis, linear regression analysis
"Relationships Between Wheelchair Provision Time for Hospital Inpatients and Their Length of Stay and Costs of Hospitalization: A Cohort Study"	Kruskal-Wallis test, Mann-Whitney U test, linear regression analysis
"Performance-Based Functional Outcomes 12 and 24 Months After Transfemoral Osseointegration in Service Members with Traumatic Unilateral and Bilateral Lower Limb Loss"	Wilcoxon signed-rank test
"Reductions in Therapy Provision in Skilled Nursing Facilities After Medicare Payment Reform and During the COVID-19 Pandemic: An Interrupted Time Series Analysis"	Segmental regression analysis
"Educational Achievements, Labor Market Attachment, and Family Establishment in Children of Parents or Siblings with Acquired Brain or Spinal Cord Injury: A Nationwide Register Study"	Linear regression analysis, logistic regression analysis
"Establishing Consensus for Prescription of Prosthetic Components for Transfemoral Bone-Anchored Limbs: An International Delphi Method Study"	Delphi
"Qualitative Examination of Chronic Care Needs of Individuals with Traumatic Brain Injury"	Qualitative examination
Journal of the American Academy of Physical Medicine and Rehabilitation	
"Advancements in Large Language Model Accuracy for Answering Physical Medicine and Rehabilitation Board Review Questions"	Descriptive statistics
"Clinical Effect of a Post-Stroke Depression Screening Program"	Logistic regression analysis
"Effects of Intermittent Pneumatic Compression on Delayed Onset Muscle Soreness and Recovery of Muscular Fatigue"	Repeated-measure ANOVA, multivariate correlation analysis
"A Goal-directed Rehabilitation Protocol for People with Transfemoral Amputation Receiving Osseointegration Prostheses"	Paired t-test
"Comparison of Baseline PROMIS-10 Scores of Mental and Physical Health of Patients with Low Back Pain"	Independent t-test, one-way ANOVA, chi-square test
"Developing an Intensive Aerobic Exercise Program After Stroke: A Pilot Study"	Paired t-test, Wilcoxon signed-rank test
"Effects of Kilohertz Versus Low-Frequency Electrical Stimulation of the Wrist Extensors in Patients After Stroke: A Randomized Crossover Trial"	Linear mixed-effect model, Mann-Whitney U test
Annals of Physical and Rehabilitation Medicine	
"A Custom-Made Sling to Achieve Personal Goals in Shoulder Pain or Subluxation in the Subacute Stroke Phase: A Pilot Study"	Wilcoxon signed-rank test, paired t-test
"Were Unmet Rehabilitation Needs Associated with Health Deterioration During COVID-19? A Cross-Sectional Study of Canadians with Disabilities"	Bivariate correlation analysis, modified Poisson regression analysis
"Effects of Long-Term Unmet Needs and Unmet Rehabilitation Need on the Quality of Life in Stroke Survivors: A Cross-Sectional Study"	Independent t-test, chi-square test, logistic regression analysis
"Effectiveness of a 3D-Printed Silicone Medial Arch Support on Foot Pain in Individuals with Pes Planus: A Randomized Controlled Trial"	Fisher's exact test, ANOVA, Kruskal-Wallis test, linear mixed-effects model
"Effect of Mindfulness and Exercise on Cognition and Emotion in Adults with Mild Deficits in the Chronic Post-Stroke Phase: A Randomized Controlled Trial"	Independent t-test, chi-square test, two-way repeated-measure ANOVA
"Effect of Different Forms of Upper Limb Muscle Training on Dyspnea in Chronic Obstructive Pulmonary Disease: A Randomized Controlled Trial"	ANCOVA
European Journal of Physical and Rehabilitation Medicine	
"Explore the Overall Benefit Index and Its Correlation with Item Difficulty in Dysphagia-Related Syndromes in the ICF Framework"	Multivariate correlation analysis, IRT model, Bayesian graphical modeling, Monte Carlo simulation, Pearson correlation analysis
"Psychometric Properties of the Chinese Version of the 12-Item Fall Risk Index for Community-Dwelling Older Adults with Stroke"	Independent t-test, Mann-Whitney U test, paired t-test, Pearson correlation analysis, Spearman correlation analysis, logistic regression analysis, receiver operating characteristics (ROC) curve analysis, intraclass correlation coefficient
"Psychometric Validation of ICF Rehabilitation Set-17 through Item Response Theory and Network Analysis: Implications for Standardized Functioning Assessment in Chinese Inpatient Rehabilitation"	Item response modeling, Monte Carlo simulation, graphical modeling
"Psychometric Assessment of the Translated and Culturally Adapted Chinese (Cantonese) Version of the Brief Memory and Executive Test (C-BMET) in People with Stroke"	Independent t-test, Mann-Whitney U test, chi-square test, intraclass correlation coefficient, ROC curve analysis
"Psychometric Validation of Comprehensive Coordination Scale to Assess the Advanced Coordination Ability in People with Stroke"	Intraclass correlation coefficient, Pearson correlation analysis, Spearman correlation analysis, ROC curve analysis

Table 1. Article titles and the statistical methods assessed in the evaluation

Assessment of Sample Size Calculation						
Journal name (number of articles)	AJPMR (8)	APMR (12)	PM&R (7)	APRM (6)	EJPRM (5)	Total (38)
Was the primary endpoint used for the sample size calculation?	1/7	0/10	2/6	3/6	3/5	9/34 (26.5%)
Was the effect size assumption clearly justified by a prior study, pilot data, or clinical judgment?	1/7	0/10	2/6	3/6	3/5	9/34 (26.5%)
Was the formula or method appropriate for the study design (e.g., equivalence, noninferiority, independent two-sample, or survival)?	1/7	0/10	2/6	3/6	3/5	9/34 (26.5%)
Was an appropriate formula used?	1/7	0/10	2/6	3/6	3/5	9/34 (26.5%)
Was the significance level appropriately described?	1/7	0/10	2/6	3/6	3/5	9/34 (26.5%)
Was the statistical power appropriately described?	1/7	0/10	2/6	3/6	3/5	9/34 (26.5%)
Was the test type (one-/two-sided) appropriately described?	1/7	0/10	1/6	0/6	1/5	3/34 (8.8%)
Was the software for determining the sample size specified?	1/7	0/10	1/6	1/6	2/5	5/34 (14.7%)
Assessment of Statistical Analysis						
Were the statistical analysis methods used appropriately?	8/8	12/12	6/6	6/6	5/5	37/37 (100%)
Were the assumptions for the statistical analysis methods checked?	3/7	4/9	0/6	2/6	3/5	12/33 (36.4%)
Were the statistical results appropriately presented?	8/8	12/12	6/6	6/6	5/5	37/37 (100%)
Were the missing data appropriately handled?	8/8	7/8	5/6	6/6	4/5	30/33 (90.9%)
Was the significance level appropriately described?	8/8	8/10	6/6	5/6	5/5	32/35 (91.4%)
Was the statistical software used for the analysis specified?	6/8	9/12	6/6	5/6	5/5	31/37 (83.8%)

Table 2. Evaluation results of sample size calculation and statistical analysis in research articles in physical medicine and rehabilitation research

Notes: Values indicate the number of articles that satisfied each evaluation criterion (yes) out of the total number of articles. Percentages in parentheses represent the overall proportion of "yes" answers for all evaluated articles for each criterion.

	AJPMR	APMR	PM&R	APRM	EJPRM	Total
Normality test for central-scale comparison tests	4/6	4/6	0/5	1/5	3/4	12/26 (46.2%)
Assumption check for regression analyses*	0/3	2/7	0/2	1/3	0/1	3/16 (18.8%)

Table 3. Evaluation of the assumption-checking results for statistical analyses across journals

*Assumptions for regression analyses: linearity, independence of errors, homoscedasticity, and absence of multicollinearity.

AJPMR: American Journal of Physical Medicine & Rehabilitation; APMR: Archives of Physical Medicine and Rehabilitation; APRM: Annals of Physical and Rehabilitation Medicine; EJPRM: European Journal of Physical and Rehabilitation Medicine; PM&R: Journal of the American Academy of Physical Medicine and Rehabilitation.