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Integrating psychological reinforcement modalities to enhance the therapeutic efficacy of physical rehabilitation for disaster survivors

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ABSTRACT

Background: Post-disaster physical rehabilitation programs in Sumatra have been running, but survivors still receive limited psychological support. Therefore, this study integrated spiritual guidance and light physical exercise to strengthen the psychological recovery process of disaster survivors.

Methods: This study applied a mixed-method approach with an exploratory design where qualitative analysis utilizes NVivo 12 to examine data sourced from online media and interviews with 15 participants representing the Regional Government and psychology experts, while quantitative analysis used the structural equation modeling partial least squares – 4 (SEM PLS-4) on data collected from 150 health workers of Universitas Pertahanan, Indonesia who served in disaster-affected areas with a structured questionnaire as a research instrument.

Results: The results of the NVivo 12 analysis identified stress, loss, uncertainty about the future, and various health problems, such as respiratory infections, diarrhea, skin diseases, and a high need for emotional support became important factors for implementing psychological recovery interventions. Based on the results of the SEM PLS-4 analysis, this finding was strengthened by showing that the integration of spiritual methods, psychosocial approaches, light physical activity, and fulfillment of basic needs had a positive and significant impact on psychological strengthening and recovery ($\beta = 0.529$; $p = 0.000$; $T = 8.651$; $R^2 = 0.280$; $F^2 = 0.389$). Furthermore, the developed model showed strong predictive capacity, as indicated by the Q^2predict value of 0.267, with a lower PLS loss than the indicator average (IA) loss ($0.149 < 0.204$).

Conclusion: Light physical activity, spiritual guidance, psychosocial support, and provision of basic needs were crucial factors in strengthening and restoring the psychological well-being of disaster survivors. Implementing holistic interventions in evacuation centers and at home has been shown to reduce stress levels, aid emotional regulation, restore physical function, and strengthen long-term mental resilience.

Keywords: disaster rehabilitation, physical activity, psychological recovery, psychosocial support, spiritual intervention.
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INTRODUCTION

Disaster survivors in Sumatra in November – December 2025 were receiving rapid and effective post-disaster physical rehabilitation from the government. However, the psychological impact on disaster survivors has not received special attention.[1] Reports from the National Disaster Management Agency, Indonesia, and the mass media indicate that approximately one million refugees require psychological rehabilitation.[2] Some psychological impacts, including anxiety, stress, depression, and grief due to the loss of family members and homes, are most commonly experienced by survivors.[3,4] Therefore, post-disaster management in Sumatra must not only focus on restoring infrastructure, public facilities, transportation access, and food security but must also prioritize the psychological recovery of survivors.[5] Previous studies have emphasized the importance of meeting basic needs, providing psychological first aid (PFA), and providing psychosocial support.[6,7]

Based on previous studies, the fulfillment of basic needs is the main factor in emotional recovery, followed by hygiene supplies, learning facilities, and PFA for women and children.[8] In the first three months after a disaster, especially for children and older adults, they will experience a high risk of experiencing psychological disorders.[9] Another study stated that individuals who experience impacts can also be found in every individual affected by a disaster.[10] Comprehensively, these studies underline the need for comprehensive psychosocial, psychological screening, and multi-actor as a way to handle the psychological impact of disaster survivors.[11,12]

This study explored: First, why psychological recovery among disaster responders in Sumatra remains suboptimal despite psychosocial support

and PFA interventions. Second, how spiritual guidance and light physical activity contribute to reducing stress and improving mental and physical balance. Third, how an integrative model combining spiritual guidance, physical activity, and psychosocial support can be developed to strengthen psychological recovery.[13]

The novelty of this research lies in the systematic integration of spiritual guidance and light physical activity into a psychological recovery framework as an approach that has never been included in post-disaster rehabilitation models in Indonesia. This integrative perspective expands conventional psychosocial interventions and PFA into a holistic recovery model that simultaneously addresses the spiritual, mental, and physical dimensions.[14,15] This study aimed to analyze the simultaneous integration of spiritual guidance techniques and light physical exercise as a psychological strengthening and holistic recovery strategy for disaster management.

METHODS

This study employed a mixed-methods approach with an exploratory design. Secondary qualitative data were obtained from 15 participants, consisting of five central government officials, five regional government officials, and five psychology experts from leading universities in Indonesia.[16,17] Primary quantitative data were collected from 150 health personnel from the Defense University assigned to disaster response units in Sumatra.[18] Data were derived from online media sources and structured Likert-scale questionnaires using a five-point Likert scale.

Qualitative data analysis followed the Creswell (2014) model and was supported by NVivo 12 software, including data collection, classification, coding, development of cases and case classifications, and analytical queries with word cloud analysis to interpret emerging themes.[17,19] Quantitative data analysis was conducted using SEM-PLS 4, including assessment of outer loadings, construct validity and reliability, discriminant validity, hypothesis testing, effect size, model estimation, and predictive model quality.[20] Data validity was validated using a triangulation method by comparing the qualitative results from Nvivo with the quantitative results from SEM-PLS 4 to strengthen credibility, reliability, and convergence across data sources.[21,22] Ethics approval was completed with informed consent with each participant clearly understanding the study's objectives and procedures.[23]

RESULTS

Findings Based on Qualitative Analysis

The floods and landslides were driven by a combination of ecological and anthropogenic factors, including the transition from an extended dry season to persistent heavy rainfall, illegal logging, land clearing for palm oil plantations, and suboptimal implementation of Environmental Impact Assessments.[24] According to official data from the National Disaster Management Agency's dashboard, the disaster had an impact on three major provinces: Aceh, North Sumatra, and Western Sumatra. The National Disaster Management Agency recorded 964 deaths, 262 people missing, and around 5,000 injured. The public infrastructure suffered significant damage, including 1,200 public facilities, 423 places of worship, 215 health facilities, 287 government buildings, 584 educational institutions, and 498 bridges.[25]

Local government reports have identified several immediate urgent needs, including the provision of medicines, the stabilisation of staple food prices by businesses, the provision of basic necessities for evacuees, and the management of various diseases that have emerged post-disaster, such as measles, acute respiratory infections (ARI), diarrhoea, and dermatological conditions. Along with health and logistical needs, migrants require prayer equipment to maintain religious rituals. In a volatile sociopolitical atmosphere, rumours emerged about the Free Aceh Movement asking for food supplies for its members. The absence of a regional leader in South Aceh at the tragedy site drew widespread public outrage, forcing a sharp response from Aceh's governor and a direct rebuke from the president of the Republic of Indonesia.[26]

An analysis of secondary data from internet media, supported by insights from psychology experts, demonstrates that the disaster had a widespread and severe psychological impact (**Figure 1**). Survivors are more likely to experience mental health issues such as sadness, anxiety, acute stress reactions, and a decreased sense of security, which are mostly caused by the loss of family members, destruction of homes, and disruption of livelihoods. Inadequate psychosocial support services and a scarcity of competent experts exacerbate psychological circumstances

Figure 1. NVivo 12 Word Cloud Analysis

in refugee camps, particularly among vulnerable populations such as children, women, and the elderly. Despite numerous initiatives, experts believe that the psychological recovery trajectory is slow, with approximately 30–50% of survivors exhibiting persistent symptoms such as anxiety disorders, prolonged grief, and possibly post-traumatic stress disorder (PTSD) within the first three months after the disaster.[27,28]

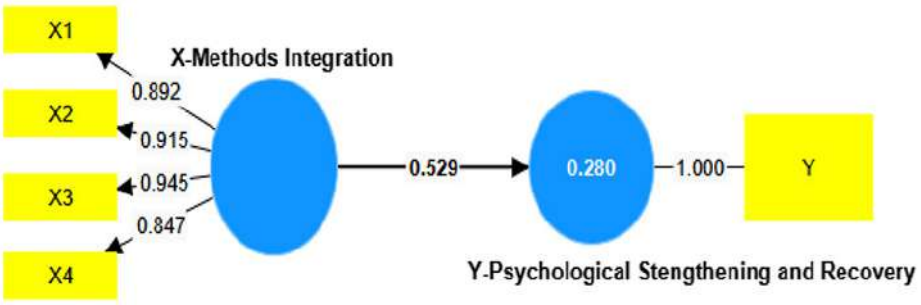

Figure 2. SEM PLS-4 Outer Loading

Quantitative Findings Analysis

Outer Model

The outer loading results for the four independent variables Spiritual Method (0.892), Psychosocial Method (0.915), Physical Activity Method (0.945), and Basic Needs Fulfillment Method (0.847) all exceed the threshold of 0.70, thereby meeting the criteria for convergent validity (**Figure 2**). These values indicate that each indicator strongly reflects its respective construct. The endogenous variable shows a loading value of 1.000, demonstrating that all dimensions consistently contribute to the psychological recovery of disaster survivors in Sumatra.[29]

The results presented in **Table 1** demonstrate strong construct validity and reliability for variable Methods Integration within the PLS-SEM framework. Cronbach's Alpha of 0.924 and Composite Reliability (rho_c) of 0.945 indicate very high internal consistency, exceeding the minimum standard of 0.70. The rho_a value of 0.969 further reinforces the construct's reliability. Additionally, the average variance extracted (AVE) value of 0.811 well above the 0.50 benchmark indicates that the indicators explain more than 81% of the construct variance. Overall, all variables satisfy the criteria for strong convergent validity and reliability.[30]

As shown in **Table 2**, discriminant validity testing using the heterotrait–monotrait ratio (HTMT) between methods integration and psychological strengthening and recovery yielded a value of 0.525, which is well below the recommended upper threshold of 0.85 or 0.90. This finding confirms adequate discriminant validity and indicates that the two constructs are conceptually distinct.[31]

As presented in **Table 3**, discriminant validity assessed using the Fornell–Larcker criterion indicates that the square roots of the AVE for methods integration (0.900) and psychological strengthening and recovery (1.000) are greater than the correlation between the two constructs (0.529). This finding demonstrates that each construct explains more variance in its own indicators than the variance shared with the other construct. Therefore, the model satisfies discriminant validity criteria, confirming that the two constructs represent distinct and non-overlapping concepts[32]

Table 1. Construct Validity and Reability

Variable	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Methods Integration	0.924	0.969	0.945	0.811

Table 2. Discriminant Validitiy-Heterotrait-Monotrait Ratio (HTMT)

Variable	Methods Integration	Psychological Stengthening and Recovery
Methods Integration		
Psychological Stengthening and Recovery	0.525	

Table 3. Discriminant Validitiy Fornell-Larcker Criterion

Variable	Methods Integration	Psychological Stengthening and Recovery
Methods Integration	0.900	
Psychological Stengthening and Recovery	0.529	1.000

Table 4. Hypothesis Testing

Hypothesis Testing	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Methods Integration and Psychological Stengthening and Recovery	0.529	0.535	0.061	8.651	0.000

Inner Model

Hypothesis testing for the relationship between methods integration and psychological strengthening and recovery showed an original sample value (O) of

0.529, indicating a significant positive effect of the integrated methods on survivors' psychological recovery. The T-statistic value of 8.651 is well above the 1.96 threshold, and a p-value of 0.000 (< 0.05) demonstrate strong statistical significance (**Table 4**). Accordingly, the proposed hypothesis is accepted.

In **table 5**, the F-square value of 0.389 indicates a medium-to-large effect of methods integration and psychological strengthening and recovery based on Cohen's criteria (0.02 = small, 0.15 = medium, 0.35 = large). This suggests that the integration of spiritual, psychosocial, physical activity, and basic-needs fulfillment methods provides a substantive contribution to strengthening the psychological recovery of disaster survivors in Sumatra.[33]

The R-square value of 0.280 and adjusted R-square of 0.276 for the dependent variable Y indicate that the integrated methods explain 28% of the variance in psychological recovery, while the remaining 72% is influenced by other factors outside the model (**Table 6**). This R-square value falls within the moderate category.[34]

The standardized root mean square residual (SRMR) values for both the saturated and estimated models are 0.074, below the maximum recommended threshold of 0.08 (**Table 7**). This demonstrates good model fit and a strong correspondence between the observed and predicted covariance matrices. The structural model used in this study can therefore be considered valid and capable of accurately representing the relationships among variables in the context of psychological recovery after disaster.[35]

Model Fit

The Q^2predict, RMSE, and MAE results for the dependent variable psychological strengthening and recovery further reinforce the model's predictive capability (**Table 8**). A Q^2predict value of 0.267 indicates good predictive relevance (Q^2predict > 0). The RMSE value of 0.865 and MAE value of 0.591 reflect relatively low prediction error, suggesting that the model is stable and sufficiently precise in predicting psychological recovery outcomes.

Table 5. F-Square

Variable	Methods Integration	Psychological Stengthening and Recovery
Methods Integration		0.389
Psychological Stengthening and Recovery		

Table 6. R-square

Dependent Variable	R-square	R-square adjusted
Psychological Stengthening and Recovery	0.280	0.276

Table 7. SRMR

Standardized Root Mean Square Residual	Saturated model	Estimated model
SRMR	0.074	0.074

Table 8. Q^2 Predict

Dependent Variable	Q^2predict	RMSE	MAE
Psychological Stengthening and Recovery	0.267	0.865	0.591

Table 9. CPAT-PLS SEM vs. indicator Average (IA)

Dependent Variable	PLS loss	IA loss	Average loss difference	t value	p value
Psychological Stengthening and Recovery	0.149	0.204	-0.055	3.913	0.000
Overall	0.149	0.204	-0.055	3.913	0.000

Comparative analysis between CPAT-PLS SEM and indicator average (IA) was conducted to evaluate predictive performance (**Table 9**). The PLS loss value of 0.149 is lower than the IA loss value of 0.204, resulting in an average loss difference of −0.055. This indicates that the PLS method provides superior predictive performance compared with the baseline IA approach. The t-value of 3.913 and p-value of 0.000 confirm that the difference is statistically significant. Thus, the PLS-SEM model employed in this study is demonstrably more accurate and robust in predicting Psychological Strengthening and Recovery than the indicator-average method.

DISCUSSION

This study shows that the floods and landslides in Sumatra were caused by a combination of natural factors, human actions, and poor environmental management. The disaster caused a lot of damage: hundreds of people died, tens of thousands of homes were destroyed, public facilities were badly damaged, and a large number of people were forced to leave their homes in three provinces.[36]

The Aceh Provincial Government found that evacuation centers needed a lot of things right away, like medicines, basic goods, and ways to deal with infectious diseases. They also needed religious support facilities. The distribution of aid was affected by social and political factors. Survivors went through a lot of emotional pain, and they are at risk of developing anxiety, long-term grief, and PTSD.[37] Psychosocial support, especially PFA, was very important, but it was hard to put into action because not everyone could get to it and there weren't enough trained staff. The findings emphasize the necessity for a holistic disaster management framework that integrates environmental mitigation, fortified basic

services, improved psychosocial support, and multisectoral collaboration to foster enduring community resilience.[38,39]

Disaster survivors require a holistic recovery approach that integrates spiritual, psychosocial, and physical activity dimensions within a unified rehabilitation framework. Spiritual support not only enhances moral resilience but also serves as a coping mechanism that restores meaning and psychological endurance after loss. Community based psychosocial interventions such as safe spaces for storytelling, group therapy, and culturally grounded activities effectively reduce emotional distress and reinforce social connectedness. Physical activities, including light exercises, group mobilization, walking routines, relaxation breathing, and other movement based practices, help relieve physiological tension and restore neuromuscular function diminished during prolonged displacement. Together, these approaches form an essential foundation for optimizing recovery at both individual and community levels.[40]

Using all of these approaches together is very important because recovery for survivors is complex and includes mental health, physical health, and social support. Support groups and spiritual activities can help people feel better about themselves and their relationships with others. Regular exercise can help keep the body's natural balance, boost happiness and reduce stress. It can also help people with PTSD and anxiety.[41] The synergistic effect of these approaches working together speeds up recovery and lowers the risk of long-term mental illnesses. It works well with Indonesian culture and society, which is known for having strong religious beliefs, strong community values, and the ability to get back on its feet after hard times. A group of physiotherapists, psychologists, doctors, nurses, and social workers can work together to help people get better faster and more completely.[42-44]

The clinical and preventive implications of this study lie in the application of integrated spiritual guidance and light physical activity as supportive approaches in post-disaster rehabilitation, which can be implemented by healthcare professionals, volunteers, and rehabilitative service facilities to strengthen survivors' psychological resilience and prevent long-term psychological disorders. The limitation of this study related to the absence of direct primary data from disaster survivors, due to humanitarian and ethical considerations, in which survivors were in a psychologically unstable condition during the early post-disaster phase.[45]

CONCLUSION

Based on the findings of this study, it was clear that the psychological support provided to those in need in Sumatra was unsatisfactory. This was due to the mental, physical, and social health of beneficiaries, as well as inadequate access to psychological support systems (first aid). This situation was characterized by a large number of staff, limited access to difficult-to-reach areas, inconvenient evacuation sites, and reports of under-severe trauma. These factors contribute to the development of psychological problems such as anxiety, distressing grief, and an increased risk of post-traumatic stress disorder.

ETHICAL CLEARANCE

This study has been approved by the institutional review board of Universitas Pertahanan, Indonesia, with registration number 15/EC/XII/2025, December 1, 2025.

CONFLICT OF INTEREST

No conflict of interest.

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AUTHOR CONTRIBUTIONS

FH designed the study, collected and processed the data, and drafted the initial manuscript. DK, YH, YS, and S contributed to study design and manuscript revision.

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