STUDY PROTOCOL

Psychomotor Therapy (PMT) Rehabilitation Nursing Plan for Older Adults with Mild Cognitive Impairment in Jinzhou, China: A Study Protocol

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ABSTRACT

Introduction: Mild cognitive impairment (MCI) represents a decline in cognitive function that may lead to dementia if untreated, creating significant social and familial challenges. Current drug treatments offer limited benefits, underscoring the need for alternative therapeutic approaches. **Objective:** This study aims to promote cognitive stimulation and improve physical coordination in older adults with MCI through a psychomotor therapy (PMT) rehabilitation nursing plan. **Methodology:** The study will be conducted in two phases. Phase 1 involves the development of a nursing plan through literature reviews and expert consultation through the Delphi method. Next, a quasi-experimental study design will be conducted in Phase 2 involving older adults with MCI, divided into a control group (CG) and an experimental group (EG). The CG will receive a standard health education, while the EG will be engaged in a 12-week PMT rehabilitation nursing plan. **Discussion:** Data will be analyzed using SPSS 28.0 software. Paired t-tests will be compared pre- and post-intervention scores, with a P value <0.05 indicating statistical significance at a 95% confidence interval (CI). Conclusion: The PMT rehabilitation nursing plan is designed to explore an evidence-based approach to managing mild cognitive impairment (MCI) in older adults, addressing both cognitive and physical needs. The study's findings may contribute to the development of innovative, effective rehabilitation strategies that could enhance geriatric care and potentially improve quality of life for this population.

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INTRODUCTION

Global ageing population is facing significant challenges, particularly the growing prevalence of cognitive impairment (1). Globally, over 55 million individuals live with dementia by 2020, a number projected to triple by 2050, with Low- and Middle-Income Countries (LMICs) bearing 60% of cases yet lacking diagnostic infrastructure (2). In Asia, rapid population aging has led to an estimated 23 million individuals living with dementia, 40% of which are in China. By 2030, East Asia's MCI prevalence is expected to rise by 68% -- a trend exacerbated by sedentary lifestyles and hypertension (3). In 2022, 13.7% of the population in China was over the age of 65 or older (4), with approximately 6% of those aged 60 and above experiencing cognitive impairment, adding pressure on healthcare systems (5). However, regional disparities persist. In high-income Asian economies (e.g., Japan, South Korea), national dementia plans prioritize early screening, whereas LMICs like China rely heavily on familial caregiving, often delaying professional

intervention due to stigma (3).

Mild Cognitive Impairment (MCI), the prodromal stage of dementia, is associated with memory loss and other cognitive declines that can affect daily functioning (6). With no definitive cure for MCI, current pharmacological treatments provide only limited benefits, leaving a critical gap in the management of this condition. This growing challenge has placed significant burdens on healthcare systems, families, and caregivers, driving the need for alternative, non-pharmacological interventions (7). Psychomotor Therapy (PMT), a non-drug rehabilitation approach based on the biopsychosocial model, integrates physical movement with cognitive engagement and has shown promise for improving cognitive and motor functions in older adults (8).

In 2011, the French Higher Health Agency issued the supplementary provisions of the decree "National 2008-2012 Family Care Plan for Alzheimer's Disease", which officially included psychomotor rehabilitation treatment in the care plan for older adults living at home with Alzheimer's disease and related diseases (9). A study showed that 11 MCIs and 11 subjectively healthy older adults(sHE) underwent a single 45-minute PMT intervention (10). Resting-state electroencephalography, the Rey Auditory-Verbal Learning Test and the Positive and Negative Affect Schedule were compared between groups and pre- and post-PMT. PMT intervention does have functional influences on the central nervous level and therefore, might prevent and treat cognitive, psychological, and psychiatric symptoms of people with mild cognitive impairment. However, this study only conducted a single intervention and had a small number of subjects. Currently, there is limited research specifically addressing its role in mild cognitive impairment (MCI). Non-pharmacological interventions such as psychomotor therapy (PMT) remain understudied in Asian contexts, despite evidence of cultural preferences for community-based, non-stigmatizing approaches (2). This underscores the urgency of developing tailored rehabilitation models that align with local healthcare.
This study aims to address this gap by developing and evaluating a PMT-based rehabilitation nursing plan specifically designed for older adults with MCI. By incorporating targeted exercises that stimulate both cognitive and motor skills, the proposed nursing plan aims to enhance cognitive function, delay cognitive decline, and improve the quality of life for older adults living with MCI.

MATERIALS AND METHODS

This study will be conducted in two phases. Phase 1 will focus on developing a specialized nursing plan tailored for older adults with Mild Cognitive Impairment (MCI) through an extensive literature review and a structured expert consultation process using the Delphi method (11, 12). A comprehensive literature review will gather existing evidence on non-pharmacological interventions, particularly Psychomotor Therapy (PMT), and their effects on cognitive and motor functions in older adults. This review will examine recent studies, systematic reviews, and guidelines related to PMT and its applications in populations with similar needs. The goal is to identify key therapeutic elements, exercises, and frameworks that could form the foundation of an effective PMT-based nursing plan for individuals with MCI. Following the literature review (13, 14), the Delphi method will be used to refine and validate the components of the nursing plan. This structured, iterative process will involve a panel of experts, including geriatric healthcare providers, physical therapists, cognitive specialists, and nursing professionals. Experts will review the proposed interventions, provide feedback, and suggest modifications. Two rounds of feedback and revisions will ensure that the final nursing plan is both evidence-based and customized to meet the unique needs of older adults with MCI. By the end of Phase 1, a comprehensive and validated PMT-based nursing plan will be ready for implementation in the next phase.

Phase 2 will use a quasi-experimental design to compare outcomes between an experimental group (EG) and a control group (CG), allowing for insight into the effectiveness of the PMT rehabilitation nursing plan for older adults with MCI while addressing ethical and practical considerations in participant selection. Older adults' herein refers to individuals ≥50 years, covering middle-aged to older populations to address the early cognitive decline and regional aging trends. Purposive sampling will be employed to select and invite older adults with MCI residing in institutional care. Participants in the experimental group, based at Jinzhou Rehabilitation Hospital (JRH), will participate in a structured PMT rehabilitation nursing intervention, while the control group, based at Jinzhou Pension Comprehensive Service Center (JPCSC), will receive standard health education. Health education was selected as the control group intervention due to its ethical alignment with providing baseline care, its capacity to control for non-specific factors (e.g., attention bias, placebo effects), and its ecological validity in reflecting standard practices within the target population. This approach ensures methodological rigor by isolating the experimental intervention's effects and minimizing resource disparities, and its minimal impact on primary outcomes compared to active treatments. Participants will be assigned to the experimental group (JRH) or control group (JPCSC) based on their existing enrollment in the respective institutions. To address potential confounding, groups will be matched on age, gender, and baseline Mini-Mental State Examination (MMSE) scores, and these variables will be included as covariates in the final analysis. Outcome assessors will be blinded to group allocation, and all cognitive assessments will follow standardized protocols to minimize measurement bias.

PMT facilitators will be licensed professionals with prior experience in geriatric care. All must complete an 8-hour training program covering protocol delivery and emergency response. To ensure protocol adherence, 20% of sessions will be randomly reviewed by a senior trainer. Facilitators will receive feedback twice a month. Frail participants will receive pre-activity medical clearance. Vital signs were monitored during sessions, with a nurse on standby.

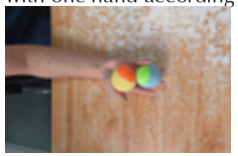
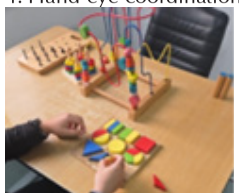
Inclusion criteria will be adults aged 50 and above with a Mini-Mental State Examination (MMSE) score below 27, indicative of cognitive impairment. Participants must be able to communicate (i.e., listen, speak, and understand) and voluntarily agree to participate, with family consent where applicable. Exclusion criteria will include individuals with mental symptoms that prevent cooperation, significant heart conditions, limb dysfunction, or a diagnosis of neurodegenerative disorders.

The sample size was estimated by using the sample size formula compared with the average of two samples (15). The sample size calculation formula and parameters were N1= N2= 2[(tα/2+tβ)S/δ]2. N1 is the sample content of the experimental group. N2 is the sample content of the control group. S is the estimated value of the standard deviation between the two populations. δ is the difference between the two averages. The S and δ were the values of the MMSE scale decided by the published journal based on expert opinion (16). Due to the lack of local pilot data, S = 2.75 and δ = 2.14 were conservatively estimated based on published SD values from Liang JZ (16), which closely matched our target population's characteristics. The level of significance (α) was 0.05, t0.05/2= 1.96, β was 0.10, t0.1= 1.28. By substituting the formula, 34 samples were required for each of the two groups. An estimated 10% was added to the calculated sample size in anticipation of some missing data. The calculated sample size for this study was 76 patients (EG: 38 patients, CG: 38 patients).

Data collection: A proforma will be prepared for data collection to record the general demographic and information of the participants. To ensure confidentiality, each participant will be assigned a unique research identification number, and no personal identifying information will be disclosed. Outcomes will be assessed at baseline (pre-intervention) and Week 12 (post-intervention) to evaluate the impact of the PMT-based nursing plan. This study will assess the effectiveness of the PMT-based nursing plan on several key variables, including cognitive, psychological, psychomotor, and mental health status. The cognitive status will be measured by the Mini-Mental State Examination (MMSE), it contains five dimensions of attention and calculation (5 items, 5 points), orientation (10 items, 10 points), language ability (9 items, 9 points), memory (3 items, 3 points), and recall ability (3 items, 3 points), with a total score of 30 points (17). Under internationally recognized criteria, an MMSE score of ≤24 indicates cognitive impairment. However, the Chinese version of the MMSE incorporates education-adjusted cutoffs to account for sociocultural and educational influences. Specifically, validated criteria for the Chinese population are stratified as follows: ≤17 points for individuals with no formal education, ≤20 points for those with primary education (1–6 years of schooling), and ≤24 points for individuals with secondary education or above (≥7 years of schooling), with scores at or below these thresholds indicating cognitive impairment. The test results of this version on 5055 elderly people aged 55 and above in Shanghai showed that the retest reliability of this version at an interval of 48-72 hours was 0.91, and the joint test reliability was 0.99 (18). It has good parallel validity with cognitive examination scales. The psychological state will be assessed using the Positive and Negative Syndrome Scale (PANSS), including the positive scale (7 items, 7-49 points), the general psychopathology scale (16 items, 16-112 points), and the negative scale (7 items, 7-49 points). The higher the score is, the worse the rehabilitation. The reliability and validity of the Chinese version of PANSS have been verified and applied in clinical practice. The internal consistency reliability was 0.87(Cronbach α). The internal consistency reliability of the five dimensions ranged from 0.74 to 0.90 (19). The structure, validity and reliability of PANSS (Chinese version) are acceptable. The psychomotor function will be evaluated with the Grooved Pegboard Test (GPT) (20, 21). Mental health will be assessed using the Cornell Dementia Depression Scale (CSDD), including 5 factors and 19 items of behavioural disorder, emotional-related performance, periodic function, concept disorder, and physical performance. Each item has 0-2 points, and the total score is 0-38 points. A score greater than 8 points indicates that the patient has mild depression, and the higher the score is, the more severe the depression. REN RJ evaluated the reliability of the Cornell Dementia Depression Scale Chinese Version (CSDD-CV) and investigated the risk factors of depression in AD patients. The results show the Cronbach α coefficient of the CSDD-CV was 0.810, and the Cronbach α coefficients of the five factors were between 0.576 and 0.788 (22). The CSDD-CV had good reliability and validity. Refer to Table I for the Mind-body Exercise of Psychomotor Rehabilitation Nursing Plan.

The PMT rehabilitation nursing plan is grounded in three foundational frameworks: Cognitive Theory, which posits that structured training (e.g., cognitive training puzzle boards, hand fine motor exercises, and hand-eye coordination drills) can enhance higher-order functions like attention, memory, and language processing (23); Neuroplasticity Theory, emphasizing the brain's adaptive reorganization through targeted activities such as breathing exercises that induce parasympathetic activation via vagal pathways and improve interoceptive awareness (24); Biopsychosocial Model, which

Table I: The Mind-body Exercise of Psychomotor Rehabilitation Nursing Plan

Domain	Week	Intervention methods	Assessment
Cognitive function	Week 1-6 Twice a week 9:00-10:00 am 1 hour	1. Do relaxation and breathing exercises before and after exercise (10 minutes). 2. Blink alternately, bulge left and right cheeks and improve facial motor function (10 minutes). 3. Hand-eye coordination training: The older adults followed instructions to grab the colourful beads with their hands and slide them along the curved track (10 minutes).  4. Cognitive training puzzle board: The older adults put puzzle pieces of different colours and shapes into the corresponding grooves according to the instructions (10 minutes).  5. Carry out upper limb gymnastics exercises to improve limb motor function (20 minutes).	1. Assessment Mini-Mental State Examination (MMSE) 2. Positive and Negative Syndrome Scale (PANSS) 3. Grooved Pegboard Test (GPT) 4. Cornell scale for depression in dementia (CSDD)
Motor function	Week 7-12 Twice a week 9:00-10:00 am 1 hour	1. Do relaxation and breathing exercises before and after exercise (10 minutes). 2. Hand muscle training/flexibility training/hand-eye coordination/improved circulation: The older adults held and rotated two balls with one hand according to instructions (10 minutes).  3. Hand fine training/flexibility training/hand-eye coordination/endurance and concentration training (10 minutes).  4. Hand-eye coordination training/cognitive ability training/fine skills training/teamwork and social interaction training (10 minutes).  5. Carry out upper limb gymnastics exercises with music to improve limb motor function (20 minutes).	

integrates biological interventions (e.g., pharmaceutical management) with psychosocial strategies including group-based limb movement exercises to foster social interaction and psychological well-being in older adults with mild cognitive impairment (25).

Procedure: The experimental group will participate in a 12-week PMT rehabilitation nursing plan featuring structured activities in cognitive and physical domains. Cognitive activities will include memory exercises, problem-solving tasks, and activities designed to improve attention and processing speed, while physical activities will focus on strength, balance, and flexibility, integrating movements that promote coordination and motor skills essential for daily functioning. Sessions will be conducted twice weekly, every Tuesday and Thursday morning, lasting 1 hour each. Meanwhile, the control group will receive standard health education on cognitive health, including information on maintaining cognitive function and overall wellness. This quasi-experimental approach will facilitate a detailed evaluation of the PMT-based nursing plan's impact on cognitive and motor functions, assessing its potential to improve the quality of life for older adults with MCI.

Data analysis: Data entry and analysis will be conducted using SPSS version 28.0 software, and descriptive statistics will summarize general participant information. Numerical data will be presented as mean (SD) or median (IQR) depending on data normality, assessed via Shapiro-Wilk tests ($p > 0.05$), and categorical data will be displayed as frequency (%). To evaluate the effectiveness of psychomotor therapy (PMT), paired t-tests will be applied to compare pre- and post-intervention MMSE scores within the experimental group. A p-value of <0.05 (two-tailed) will be considered statistically significant, and a 95% confidence interval (CI) will quantify the precision of effect estimates. For between-group comparison, independent t-tests will compare post-intervention MMSE score changes between experimental and control groups. Cohen's d will be calculated for all paired and independent comparisons to assess clinical significance. If normality assumptions are violated (Shapiro-Wilk $p < 0.05$), Wilcoxon signed-rank tests (paired) and Mann-Whitney U tests (independent) will replace parametric tests.

To address potential attrition, we will employ proactive retention strategies (e.g., regular phone reminders) and statistical methods for missing data. Participants lost to follow-up will be compared with completers on baseline characteristics to assess potential bias. If attrition occurs, we will use chained equations (MICE algorithm) to impute missing MMSE scores and other outcomes, incorporating baseline variables (age, gender, baseline MMSE, et al.) and prior assessment data (26). The intention-to-treat (ITT) analysis will serve as the primary approach for all efficacy evaluations. All participants, regardless of adherence to the intervention or dropout during follow-up, will be included in their originally assigned groups. As a secondary analysis, a per-protocol (PP) analysis will be conducted, restricted to participants who completed ≥75% of the PMT sessions and all scheduled assessments. This analysis aims to estimate the intervention's efficacy under optimal implementation conditions.Figure 1 depicts the flow of the plan for this study.

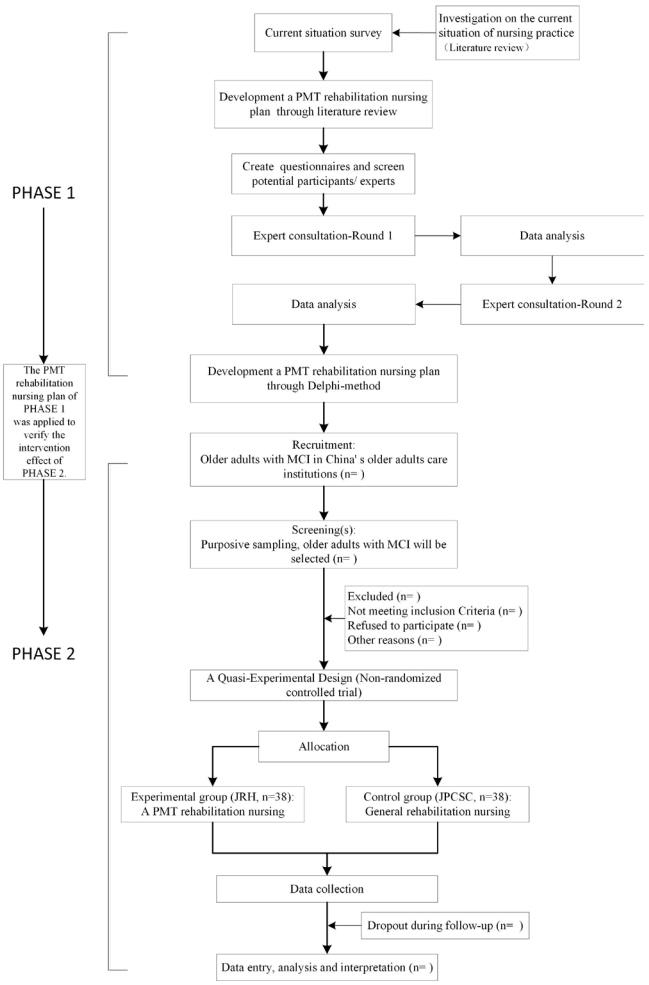


Figure 1: Study flow chart

DISCUSSION

The clinical manifestations of Mild Cognitive Impairment (MCI) primarily include declines in memory, language, attention, executive function, visuospatial abilities, calculation skills, sensory processing, and coherent thinking (27). However, it is important to note that not all individuals with MCI will progress to dementia. Recent research has explored dementia-related factors, including biomarkers, diagnostic criteria, and potential interventions, yet managing MCI effectively remains a challenge (28-30). A lack of standardized diagnostic criteria and tools in China results in variable prevalence rates and inconsistent diagnostic practices, while the limited number of longitudinal studies hampers understanding of MCI progression. Without a consensus on MCI heterogeneity, diagnostic standards, and optimal treatments, translating research findings into clinical

settings has been difficult, leaving few evidence-based strategies to prevent or delay dementia onset in MCI patients. This underscores a growing need for effective, practical, and accessible interventions.

Alzheimer's Disease International has taken steps toward addressing this gap, funding research on both pharmacological and non-pharmacological interventions aimed at modifying disease progression, addressing underlying causes, and managing symptoms (6). Among these, Psychomotor Therapy (PMT) stands out as a unique approach that combines physical movement with cognitive engagement, offering a passive yet comprehensive intervention that targets multiple facets of cognitive and motor function. PMT is particularly advantageous because it is a gentle, adaptable method, suitable for older adults who may not tolerate more aggressive physical approaches. Unlike high-intensity physical interventions, which may be challenging for frail elderly populations, PMT's structured yet passive approach is well-suited to their needs, providing physical and cognitive stimulation without undue physical strain (31).

The sustainable, long-term potential of PMT lies in its ability to support cognitive health through repeated, gentle engagement, helping preserve and strengthen neural connections without overtaxing the body. Unlike single-domain therapies such as memory exercises or targeted physical rehabilitation, PMT engages a broad spectrum of functions, addressing cognitive, motor, and social components in a unified approach that has shown promise in delaying cognitive decline (32). By emphasizing coordination and purposeful movements, PMT activates various areas of the brain, fostering neuroplasticity and promoting sustained cognitive resilience over time (10). Personalized PMT treatment plans further enhance this potential by aligning with each individual's strengths and limitations, thereby optimizing the therapeutic benefits.

In recent years, there has been a growing focus on non-drug interventions for MCI management, including music therapy, transcranial magnetic stimulation (TMS), phototherapy (light therapy), electrotherapy, acupuncture, Tai Chi, Baduanjin (a traditional Chinese exercise), hyperbaric oxygen therapy (HBOT), and memory therapy (33-42). However, many of these approaches focus on isolated cognitive domains, limiting their effectiveness in addressing the multidimensional challenges of MCI. PMT's low-intensity yet comprehensive structure demonstrates superior suitability for sustainable long-term outcomes, particularly in older adults for whom intensive physical interventions are contraindicated.

While PMT is relatively new in China, more research is necessary to validate its effectiveness, identify suitable populations, and assess its acceptance by patients and their families. Given its potential as a low-impact, holistic approach that can enhance cognitive resilience and improve quality of life, PMT represents a promising pathway in MCI management and a valuable addition to MCI care strategies focused on sustainable, long-term health outcomes.

CONCLUSION

In conclusion, as the prevalence of Mild Cognitive Impairment (MCI) continues to rise alongside the aging population, addressing its progression and impact on quality of life has become a significant healthcare priority. While advances in pharmacological and non-pharmacological interventions have been made, limitations persist in both diagnosis and treatment strategies, particularly within the Chinese context where standardized diagnostic criteria are lacking, and varied prevalence estimates challenge cohesive understanding and management. This paper explores the potential of Psychomotor Therapy (PMT) as a comprehensive, sustainable, and gentle intervention uniquely suited for older adults with MCI. Unlike more aggressive physical treatments, PMT is designed to provide a structured, passive approach that addresses both cognitive and motor functions through low-intensity, adaptable exercises. Such an approach may align with the physical capabilities of frailer individuals while engaging cognitive domains in ways that might delay the onset of dementia and potentially improve quality of life.

PMT's holistic focus on integrating physical movement with cognitive engagement could offer broad therapeutic benefits for MCI's complex symptoms, making it a promising candidate for wider implementation. Despite its promise, PMT is relatively new in China, underscoring the need for further research to establish efficacy, identify suitable patient populations, and ensure acceptance among patients and their families. The anticipated findings of this study may inform innovative and effective cognitive rehabilitation plans for older adults in care institutions, rehabilitation hospitals, community settings, and even family environments, ultimately expanding access to beneficial MCI interventions. Future work should aim to standardise MCI diagnostic tools, develop tailored PMT intervention protocols, and conduct longitudinal studies to monitor long-term outcomes. As the field progresses, a well-structured PMT program could play a critical role in bridging the gap between clinical research and practical applications, potentially contributing to sustainable cognitive health and a better quality of life for older adults with MCI.

Ethical consideration

This study has obtained ethical approval from two established human Ethics Committees: the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/PP/24090806) and the Medical

Ethics Committee of Jinzhou Medical University (JZMULL2025230). Throughout the research process, the researchers will follow the ethical guidelines set by academic and research institutions. All data collection, analysis, and reporting will strictly adhere to scientific norms and standards, ensuring independence and freedom from external influences. Before beginning the questionnaire or interview, clearly explain the purpose, content, and participants' choices, ensuring that they fully understand their rights and know they can withdraw at any time without affecting their rights. The names of the participants are only used for data collection, and their identity information will not be disclosed. All aspects of the study will be strictly confidential, and only the research team will have the right to access information on participants.

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