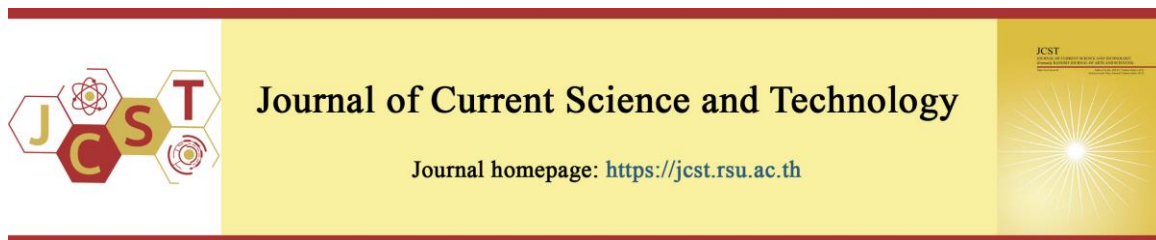


Cite this article: Tanthanapanyakorn, P., Khantikulanon, N., Weschasat, T., & Mungkhunthod, S. (2026). Prevalence and multidimensional determinants of mild cognitive impairment among urban-dwelling older adults in Pathum Thani, Thailand: A cross-sectional study. *Journal of Current Science and Technology*, 16(4), Article 215. <https://doi.org/10.59796/jcst.V16N4.2026.215>



Prevalence and Multidimensional Determinants of Mild Cognitive Impairment among Urban-Dwelling Older Adults in Pathum Thani, Thailand: A Cross-Sectional Study

Phannathat Tanthanapanyakorn¹,
Nonlapan Khantikulanon²,
Tassanapan Weschasat³,
Sootthikarn Mungkhunthod^{1,*},

¹Department of Public Health, Faculty of Public Health, Valaya Alongkorn Rajabhat University under the Royal Patronage, Pathum Thani 13180, Thailand

²Department of Environmental Health, Faculty of Public Health, Valaya Alongkorn Rajabhat University under the Royal Patronage, Pathum Thani 13180, Thailand

³Department of Occupational Health and Safety, Faculty of Science and Technology, Surat Thani Rajabhat University, Surat Thani 84100, Thailand

*Corresponding author; E-mail: Sootthikarn@vru.ac.th

Received 24 April 2026; Revised 21 May 2026; Accepted 27 May 2026; Published 15 September 2026

Abstract

Mild cognitive impairment (MCI) is a stage of cognitive decline beyond normal aging that has not progressed to dementia and is increasingly recognized as a major public health concern worldwide. However, population-based evidence on MCI in urban Thailand remains limited. This cross-sectional study assessed the prevalence of MCI and its multidimensional determinants among older adults in an urban community in Pathum Thani, Thailand. A total of 414 adults aged 60 years or older were recruited using multistage sampling between September and November 2025. Cognitive status was assessed using the Thai Mental State Examination (TMSE; cutoff ≤ 23 , indicating MCI), while depressive symptoms and perceived stress were evaluated using the PHQ-9 and ST-5, respectively. Associations were examined using univariable and multivariable logistic regression analyses. The prevalence of MCI was 35.0%, affecting more than one-third of the participants. Multivariable analysis identified nine factors significantly associated with MCI: older age, lower educational attainment, unemployment, low income, physical inactivity, depression, elevated stress, limited social participation, and lack of engagement in brain-training activities ($p < 0.05$). Knowledge of MCI was not significantly associated with MCI after adjustment ($p > 0.05$). These findings highlight the multifactorial nature of MCI in urban settings and emphasize the need for targeted, community-based screening and integrated health-promotion strategies that address modifiable risk factors in Thailand's rapidly aging population.

Keywords: cognitive dysfunction, aged, prevalence, urban health, cross-sectional studies, risk factors, depression, Thailand

1. Introduction

The global population is aging rapidly, with adults aged 60 years or older projected to account for approximately 22% of the world's population by 2050, representing nearly 2.1 billion people (World

Health Organization (WHO), 2022; United Nations, 2023). This demographic shift is particularly evident in low- and middle-income countries, where healthcare systems face increasing pressure. Thailand has already entered an aging society, with older adults

comprising more than 20% of the population in 2023 and the proportion expected to exceed 28% by 2040 (National Statistical Office, 2023). Pathum Thani Province, located within the Bangkok Metropolitan Region, reflects these trends, with rapid urbanization accompanied by population aging and increasing burdens of chronic disease and cognitive decline.

Aging involves complex biological, psychological, and social changes that increase vulnerability to cognitive impairment. Physiological decline across multiple systems, combined with chronic conditions such as hypertension and diabetes, contributes to progressive neurological deterioration (Livingston et al., 2024). At the same time, reduced social participation, isolation, and weakening support systems in urban environments further elevate cognitive risk (Zhang et al., 2025). These interacting processes contribute to the development of mild cognitive impairment (MCI), a condition characterized by cognitive decline beyond normal aging that does not yet significantly impair daily functioning (Wang et al., 2024). MCI affects approximately 15-20% of older adults globally and is associated with a substantially increased risk of progression to dementia (Alzheimer's Association, 2024; Fowler et al., 2025).

Previous studies in Thailand have already documented cognitive impairment and MCI in both urban and rural settings. For instance, Srisupornkornkool et al. (2022) examined prevalence and associated factors in an urban community in Phitsanulok, while Griffiths (2020) investigated MCI determinants in rural northern Thailand. Tiraphat and Aekplakorn (2018) also reported differences in cognitive impairment across urban and rural populations. However, these studies were constrained by their analytical scope, typically examining determinants within isolated domains such as demographic or clinical variables rather than capturing the combined influence of psychosocial, behavioral, and cognitive engagement factors within a single model. Critically, empirical evidence on MCI prevalence and its determinants using validated research methods in Pathum Thani Province specifically remains absent from the published literature, representing a significant gap given the province's distinct urban demographic profile and its rapid transition into an aged society within the Bangkok Metropolitan Region.

Moreover, existing studies in Thailand have not yet comprehensively examined the multidimensional determinants of MCI within a unified analytical framework. MCI is increasingly recognized as a condition shaped by interacting pathways, and the

absence of integrated, multivariable approaches limits the ability to identify co-occurring and modifiable risk profiles. In particular, no prior Thai community-based study has simultaneously evaluated psychosocial determinants, including depression, stress, and social participation, alongside cognitive engagement behaviors such as brain-training activities and technology use, despite evidence that these factors may operate synergistically. Furthermore, the role of disease-specific knowledge in relation to cognitive outcomes remains underexplored. Although health literacy theory (Nutbeam, 2000) and the Health Belief Model (Pender et al., 2015) suggest that knowledge may facilitate preventive behavior, empirical findings indicate that knowledge does not always translate into action because of structural and contextual constraints, thereby creating a knowledge-behavior gap (Dong et al., 2026).

To address these gaps, the present study adopts an integrated five-domain framework that simultaneously examines sociodemographic, physical health, psychosocial, cognitive-engagement, and knowledge-related factors within a single community-based analysis. By considering these domains concurrently, this study seeks to advance understanding of the multiple factors that influence MCI and to identify modifiable risk factors that have not previously been examined together in the Thai context. Accordingly, this study aimed to determine the prevalence of MCI and to explore factors associated with MCI across five domains among older adults living in an urban community in Pathum Thani Province, Thailand.

2. Objectives

This study aimed to determine the prevalence of MCI and examine factors associated with MCI across five domains: sociodemographic characteristics, physical health and behavioral factors, psychosocial factors, cognitive engagement, and knowledge of MCI among older adults in an urban community in Pathum Thani, Thailand.

3. Materials and Methods

3.1 Study Design and Conceptual Framework

This cross-sectional study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Von Elm et al., 2007). The conceptual framework was developed based on a systematic review of relevant theories and empirical studies on MCI in older adults. The study drew on two

complementary theoretical models. First, the Determinants of Health Framework was used to acknowledge that health outcomes are shaped by multiple hierarchical levels of influence, from individual biological and lifestyle characteristics to broader social, community, and structural conditions (Dahlgren & Whitehead, 1991). This framework guided the inclusion of sociodemographic factors such as age, gender, education level, marital status, occupation, monthly income, and living arrangement, as well as knowledge of MCI, as individual-level and structural determinants shaping cognitive health outcomes. Second, the Biopsychosocial Model (Engel, 1977) was incorporated to emphasize that cognitive health arises from the dynamic interaction among biological, psychological, and social determinants rather than from any single factor in isolation. In operationalizing this framework,

biological factors were captured through physical health variables, including health condition, daily medication use, sensory impairment, fall history, physical activity, and sleep duration; psychological factors were captured through measures of stress and depression; social factors were captured through living arrangement, community and social activity participation, and social support; and cognitive-engagement factors were captured through smartphone and digital technology use and brain-training activities, which both theoretical models recognize as modifiable protective factors. Based on these theoretical foundations, the independent variables were classified into five domains: (1) sociodemographic factors, (2) physical health and behavioral factors, (3) psychosocial factors, (4) cognitive-engagement factors, and (5) knowledge of MCI (Figure 1).

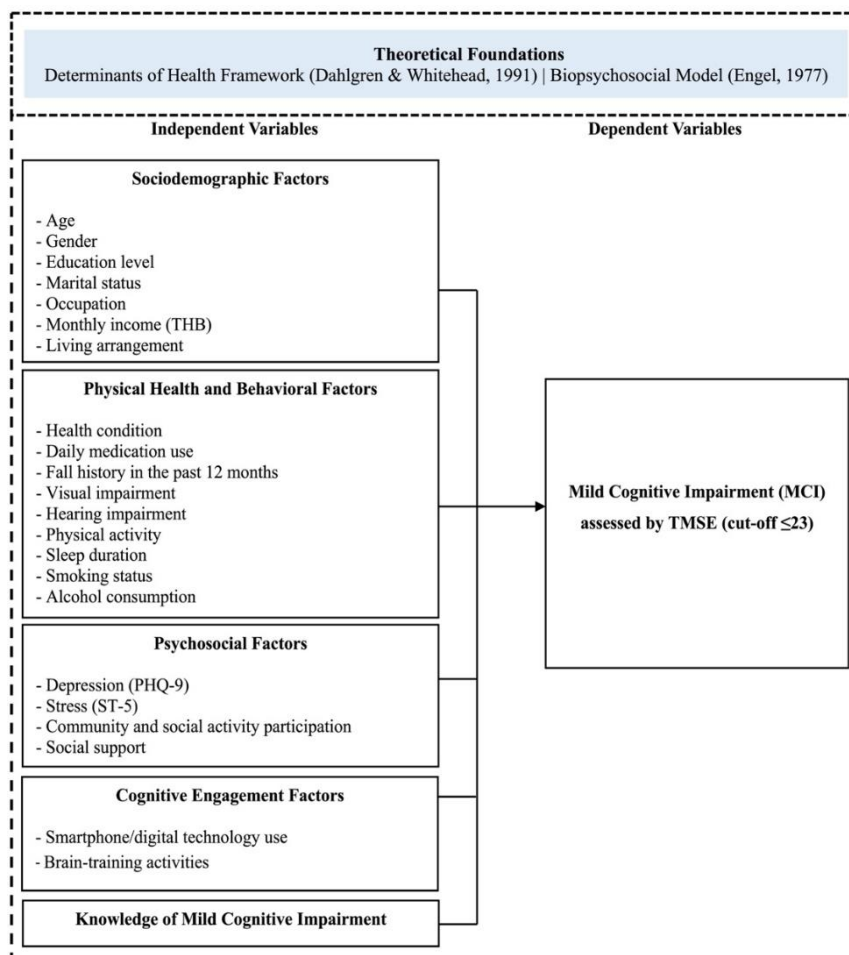


Figure 1 Conceptual framework for studying determinants of mild cognitive impairment

3.2 Participants

The study included older adults aged 60 years or older who lived in communities within urban areas of Pathum Thani Province. Provincial demographic data from the Department of Older Persons, Ministry of Social Development and Human Security (2025) reported a total provincial population of 1,246,062, of whom 234,032 individuals (18.78%) were aged 60 years or older, reflecting a substantial and growing older population in the province and highlighting the need for age-focused health planning. The sample size was estimated using the Cochran (1977) formula, which is suitable for large populations with a small sampling fraction. Three input parameters were used: a 95% confidence level ($Z = 1.96$), a prior MCI prevalence estimate of 34% ($p = 0.34$) drawn from the closest comparable urban study in Thailand (Pinyopornpanish et al., 2024), and a margin of error of 0.05. These parameters yielded a minimum sample size of 345 participants. A 20% upward adjustment was applied to compensate for anticipated non-response, missing data, or participant attrition, bringing the final enrollment target to 414 older adults.

3.3 Sampling Process

A multistage sampling approach was adopted to obtain a representative sample of older adults from urban communities in Pathum Thani Province. In the first stage, one district was randomly selected from the seven administrative districts, resulting in the selection of Khlong Luang District. In the second stage, urban communities within Khlong Luang Hospital's service area were purposively selected, because of the hospital's role as a central primary care hub supported by active community registries, surveillance infrastructure, and established Village Health Volunteers (VHV) partnerships. Eight communities within this catchment area were included. In the third stage, participants were recruited through proportional allocation across the eight communities, with each community's enrollment target set in proportion to the size of its older adult population. Recruitment proceeded until the target of 414 participants was achieved. To minimize under coverage and selection bias, eligible individuals were systematically identified through community health registries and local health networks.

3.4 Inclusion and Exclusion Criteria

To qualify for enrollment, participants had to satisfy all of the following conditions: (1) be 60 years

of age or older; (2) currently reside in one of the selected urban communities in Pathum Thani Province; (3) have lived continuously in the area for a minimum of six months before data collection, ensuring familiarity with the local environment and healthcare system; (4) be able to communicate in Thai; (5) demonstrate preserved independence in basic daily activities, defined as a Barthel Index score of 12 or above, consistent with standard MCI diagnostic requirements; and (6) be willing to provide written informed consent independently. Individuals were excluded if they had a prior diagnosis of dementia or any other major neurocognitive disorder, severe mental illness such as psychosis or schizophrenia, an acute medical condition at the time of data collection, or a neurological disorder with persistent cognitive sequelae, including stroke with neurological deficits or Parkinson's disease. Those with uncorrected severe visual or hearing impairments that would compromise cognitive testing were also excluded, as were individuals who could not complete the assessment owing to severe physical frailty, language barriers, or voluntary withdrawal at any point during the study.

3.5 Research Instruments

Data were collected using a structured questionnaire administered through in-person interviews. The instrument consisted of seven sections and was developed based on an extensive review of theoretical concepts and empirical studies, followed by validation to ensure its appropriateness for the target population.

Part 1: Sociodemographic characteristics.

This section included both open-ended and closed-ended questions designed to capture participants' demographic profiles, including age, sex, educational attainment, marital status, occupation, monthly income, and living arrangements.

Part 2: Physical health and behavioral factors. This section assessed health status and lifestyle-related behaviors, including existing medical conditions, daily medication use, history of falls within the past 12 months, visual and hearing impairments, level of physical activity, sleep duration, smoking behavior, and alcohol consumption.

Part 3: Psychosocial factors and cognitive engagement. Information on psychosocial conditions and cognitive engagement was obtained by assessing participation in social and community activities, perceived social support, use of smartphones or digital

technologies, and involvement in brain-training activities.

Part 4: Stress (ST-5). Perceived stress was measured using the Stress Test-5 (ST-5), a standardized five-item screening tool developed by the Department of Mental Health, Ministry of Public Health, Thailand (Department of Mental Health, 2009). The instrument assesses stress-related experiences during the previous two to four weeks, including sleep problems, reduced concentration, irritability, feelings of boredom, and social withdrawal. Each item is scored on a scale from 0 to 3, resulting in a total score ranging from 0 to 15. Scores are categorized into four levels: minimal (0–4), moderate (5–7), high (8–9), and very high stress (10–15) (Department of Mental Health, 2009).

Part 5: Patient Health Questionnaire-9 (PHQ-9). Depressive symptoms were evaluated using the PHQ-9, a nine-item self-report instrument based on the diagnostic criteria for major depressive disorder (Kroenke et al., 2001). Participants reported the frequency of symptoms experienced during the past two weeks using a four-point scale (0 = not at all to 3 = nearly every day), with total scores ranging from 0 to 27 (Lotrakul et al., 2008). Severity levels were classified as minimal (0–4), mild (5–8), moderate (9–14), moderately severe (15–19), and severe depression (20–27). A cut-off score of ≥ 9 was used to indicate clinically significant depressive symptoms, consistent with Thai validation studies (Lotrakul et al., 2008).

Part 6: Knowledge of MCI. MCI-related knowledge was assessed using a researcher-developed, 15-item true/false questionnaire grounded in Bloom's Taxonomy (Bloom et al., 1956). The items covered five key domains: the definition, risk factors, prevention, behavioral modification, and early detection of MCI. Total scores ranged from 0 to 15 and were categorized as low (0–8), moderate (9–11), and high (12–15).

Part 7: Thai Mental State Examination (TMSE). Cognitive function was assessed using the TMSE, a widely used and validated screening instrument applied in Thai community and clinical settings. The instrument evaluates six cognitive domains, namely orientation, registration, attention, calculation, language, and recall, with a maximum possible score of 30 points. Participants who scored 23 points or lower were classified as having MCI, consistent with established Thai normative reference values (Train the Brain Forum Committee, 1993). Because functional independence was verified using the Barthel Index (score ≥ 12), the TMSE-based classification used in this study aligns with standard

MCI diagnostic requirements, which specify that cognitive decline must occur in the context of preserved daily functioning (Mahoney & Barthel, 1965; Petersen, 2004). The TMSE requires approximately 10 minutes to administer, making it practical for community-based use. For participants without formal education, items requiring reading or writing were replaced with oral equivalents to minimize literacy-related bias, in accordance with standardized TMSE administration protocols.

The content validity of the researcher-developed sections (Parts 1–3 and Part 6) was evaluated by a panel of experts comprising a geriatric physician, a geriatric nursing specialist, and a public health expert. The Index of Item-Objective Congruence (IOC) values ranged from 0.80 to 0.96, exceeding the acceptable threshold of 0.50. The ST-5 and PHQ-9 have been validated in Thai populations and have established psychometric properties (Department of Mental Health, 2009; Lotrakul et al., 2008). The TMSE has also demonstrated acceptable validity and reliability in Thai community and clinical settings (Train the Brain Forum Committee, 1993). Reliability was evaluated in a pilot study involving 30 older adults who had characteristics similar to those of the target population but were not included in the final sample. Internal consistency ranged from acceptable to high, with Cronbach's alpha values of 0.91 for the ST-5, 0.95 for the PHQ-9, and 0.74 for the TMSE. The reliability of the MCI knowledge questionnaire was assessed using the Kuder-Richardson Formula 20 (KR-20), which yielded a coefficient of 0.95.

3.6 Data Collection Process

Data collection was conducted from September through November 2025 across eight urban communities in Khlong Luang District, Pathum Thani Province. Formal approvals were obtained from the Pathum Thani Provincial Public Health Office and the Director of Khlong Luang Hospital before data collection commenced. Potential participants were identified through community health registries and screened according to the predefined inclusion and exclusion criteria. Before enrollment, each participant received a detailed explanation of the study's aims, procedures, potential risks, and expected benefits and provided written informed consent.

The principal investigator, together with trained VHV from Khlong Luang Hospital, conducted structured, face-to-face interviews. All interviewers completed standardized training in interview methodology, instrument administration, and research

ethics, guided by a uniform field manual. Each interview took approximately 45 minutes. Data quality was maintained through continuous oversight by the principal investigator, systematic review of questionnaires for completeness and accuracy, and re-interviewing when responses were missing or inconsistent.

Several strategies were employed to minimize bias. The use of validated instruments reduced measurement error; adherence to a uniform interview protocol reduced interviewer variability; maintaining participant privacy limited social desirability effects; the use of short retrospective periods of two to four weeks minimized recall bias; and the application of explicit eligibility criteria reduced selection bias.

3.7 Statistical Method

All statistical analyses were conducted using IBM SPSS Statistics (version 29.0.1; IBM Corp.), with the level of significance set at $p < 0.05$. To examine the relationships between the independent variables and mild cognitive impairment (MCI), univariable logistic regression was initially performed to estimate unadjusted associations. Subsequently, all variables were entered simultaneously into a multivariable logistic regression model to identify factors independently associated with MCI after controlling for potential confounders. Before model estimation, the key assumptions of logistic regression were evaluated and found to be satisfied. The outcome variable was dichotomized based on TMSE scores into normal cognitive function (> 23) and MCI (≤ 23). Each observation represented an individual participant, thereby ensuring the independence of the data. The final model was constructed using the Enter method, with all variables included based on theoretical and empirical justification rather than data-driven selection procedures, thereby preserving the conceptual multidomain framework. The results are presented as crude odds ratios (CORs) and adjusted odds ratios (AORs), each with corresponding 95% confidence intervals. Model fit was assessed using the Hosmer–Lemeshow goodness-of-fit test and Nagelkerke’s R^2 .

Multi-level variables were dichotomized before modeling on clinical and public health grounds: physical activity (none vs. mild or regular), perceived stress (minimal vs. moderate to very high), MCI knowledge (low or moderate vs. high), sleep duration (< 8 vs. ≥ 8 hours per night), community participation (no participation vs. any participation), and visual and hearing impairment (any vs. none),

smoking status (never vs. ever smoked), and alcohol consumption (non-drinker vs. drinker). Reference categories were selected a priori on the basis of theoretical reasoning, empirical evidence, and public health relevance. Multicollinearity was evaluated using the variance inflation factor (VIF), with values below 5 considered acceptable. No missing data were observed in the final dataset, as the sample size was increased by 20% during recruitment to accommodate non-response and incomplete data.

3.8 Ethical Statements

Ethical approval for this research was obtained from the Institutional Review Board (IRB) of Valaya Alongkorn Rajabhat University under the Royal Patronage (REC No. 0069/2025; COA No. 0084/2025) on September 15, 2025. Written informed consent was obtained from all participants before enrollment in the study. Participants were explicitly informed that they were free to withdraw from the study at any time without consequences for their access to healthcare or community services. All collected data were handled with strict confidentiality, stored securely, and anonymized before analysis. All procedures conducted in this study fully adhered to the ethical standards outlined in the Declaration of Helsinki.

4. Results

4.1 Sociodemographic Factors among Urban-Dwelling Older Adults

Among the 414 participants, 52.7% were female, and the mean age was 69.21 years (standard deviation [SD] = 7.32; range: 60–91). Most participants were aged 60–69 years (60.1%), followed by those aged 70–79 years (25.9%) and ≥ 80 years (14.0%). Educational attainment was generally low, with nearly three-quarters of participants (74.4%) having less than a secondary education and only 12.1% holding a diploma or higher qualification. The majority were married (66.4%), whereas 19.1% were widowed, divorced, or separated, and 14.5% were single or had never married. Most participants were unemployed (65.2%) and had a monthly income of 0–5,000 Thai Baht (THB) (64.3%). The mean monthly income was $6,171.59 \pm 9,356.33$ THB (range: 0–70,000). Regarding living arrangements, most participants lived with their children or grandchildren (49.5%), followed by those living with a spouse (40.3%), while only 10.2% lived alone.

4.2 Physical Health and Behavioral Factors among Urban-Dwelling Older Adults

In terms of physical health, nearly three-quarters of the participants (72.2%) reported at least one chronic condition. Hypertension was the most frequently reported condition (56.3%), followed by hyperlipidemia and diabetes mellitus (34.1% each), osteoarthritis (22.7%), allergic disease (5.8%), and asthma (3.1%). Regarding medication use, 46.6% took one to two medications daily, while 20.3% met the criterion for polypharmacy (≥ 3 medications). Most participants reported no falls during the preceding 12 months (81.2%), whereas 18.8% experienced at least one fall. Mild visual impairment was reported by 56.5% of participants and severe visual impairment by 10.4%. For hearing impairment, 18.8% reported mild impairment and 4.3% reported severe impairment.

Regarding lifestyle behaviors, 50.0% engaged in mild physical activity, 18.4% exercised regularly, and 31.6% were physically inactive. The mean sleep duration was 6.89 ± 1.33 hours per night, with 65.9% sleeping fewer than 8 hours per night. The majority had never smoked (83.6%), while 9.2% were former smokers and 7.2% were current smokers. Regarding alcohol consumption, most participants were non-drinkers (80.4%), followed by occasional drinkers (17.4%) and regular drinkers (2.2%).

4.3 Psychosocial Factors and Cognitive Engagement among Urban-Dwelling Older Adults

With respect to psychosocial factors, most participants had no depression, as assessed using the PHQ-9 (80.9%; mean score: 4.31 ± 5.59 ; range: 0–21), and reported minimal stress on the ST-5 (84.8%; mean score: 2.04 ± 3.08 ; range: 0–15). Regarding social engagement, 44.4% sometimes participated in community or social activities, 13.3% participated regularly, and 42.3% reported no participation. Social support was available to 86.2% of participants. Regarding cognitive engagement, 36.5% regularly used smartphones or digital technology, whereas 70.3% reported no participation in brain-training activities.

4.4 Knowledge of MCI among Urban-Dwelling Older Adults

The distribution of MCI knowledge scores is presented in Table 1. The majority of participants demonstrated a high level of knowledge (score: 12–15; 85.5%), while 6.8% and 7.7% were classified as having moderate (score: 9–11) and low (score: 0–8)

levels of knowledge, respectively. The mean knowledge score was 13.09 ± 3.85 (range: 0–15).

Table 1 Distribution of participants by knowledge of mild cognitive impairment (n = 414)

Knowledge of MCI	Number	Percentage
Low (0-8)	32	7.7
Moderate (9-11)	28	6.8
High (12-15)	354	85.5
Mean $\pm$ SD, 13.09 ± 3.85 , Min-Max= 0-15		

MCI, Mild Cognitive Impairment

4.5 Prevalence of MCI Assessed by TMSE

Table 2 presents the prevalence of MCI based on TMSE scores. Of the 414 participants, 145 (35.0%) were classified as having MCI, based on a TMSE score of 23 points or lower, while the remaining 269 participants (65.0%) demonstrated normal cognitive function. The mean TMSE score for the overall sample was 25.31 (SD = 4.53; range: 5–30). This prevalence indicates that more than one in three older adults in this urban community may be at elevated risk of progressive cognitive deterioration.

Table 2 Prevalence of mild cognitive impairment assessed by TMSE (n = 414)

Mild cognitive impairment	Number	Percentage
No (> 23 points)	269	65.0
Yes (≤ 23 points)	145	35.0
Mean $\pm$ SD, 25.31 ± 4.53 , Min-Max= 5-30		

MCI, Mild Cognitive Impairment; Thai Mental State Examination

4.6 Determinants of MCI among Urban-Dwelling Older Adults

Factors associated with MCI after full covariate adjustment are presented in Table 3. Twenty-three independent variables across five analytical domains were evaluated for their associations with MCI after covariate adjustment, nine of which reached statistical significance. In the sociodemographic domain, advancing age showed the strongest association with MCI.

Multicollinearity among the predictors was assessed using the variance inflation factor (VIF). All VIF values were below 2.0, indicating no evidence of problematic multicollinearity. Older adults in the middle-old group (70–79 years) were 15.53 times more likely to have MCI than those in the young-old group (60–69 years) (AOR = 15.53, 95% CI = 6.43–37.52, $p < 0.001$). Those in the oldest-old group (≥ 80 years) had the highest odds of MCI, at 21.96 times those of the reference group (AOR = 21.96, 95% CI = 9.09–53.05, $p < 0.001$). Older adults with less than a

secondary education were 2.49 times more likely to have MCI than those with a secondary education or higher (AOR = 2.49, 95% CI = 1.11–5.57, $p = 0.026$). Unemployed participants had 5.18 times greater odds of MCI than their employed counterparts (AOR = 5.18, 95% CI = 2.50–10.76, $p < 0.001$). In addition, older adults with a monthly income of 0–5,000 THB were 2.23 times more likely to have MCI than those earning more than 5,000 THB per month (AOR = 2.23, 95% CI = 1.12–4.46, $p = 0.023$).

In the physical health and behavioral domain, physical inactivity was independently associated with MCI. Older adults who engaged in no physical activity were 2.45 times more likely to have MCI than those who engaged in mild or regular physical activity (AOR = 2.45, 95% CI = 1.30–4.61, $p = 0.005$).

In the psychosocial domain, depression showed the strongest association with MCI. Older adults with depression were 8.63 times more likely to have MCI than those without depression (AOR = 8.63, 95% CI = 3.56–20.92, $p < 0.001$). Those with moderate to high stress had 3.91 times greater odds of MCI than those with minimal stress (AOR = 3.91, 95% CI = 1.68–9.05, $p = 0.001$). Furthermore, older adults who did not participate in community or social activities were 3.07 times more likely to have MCI than those who were actively engaged (AOR = 3.07, 95% CI = 1.61–5.85, $p < 0.001$).

In the cognitive engagement domain, older adults who did not participate in brain-training activities were 3.99 times more likely to have MCI than those who actively participated in such activities (AOR = 3.99, 95% CI = 1.81–8.82, $p < 0.001$).

In the MCI knowledge domain, no statistically significant association was observed after adjustment for covariates (AOR = 1.34, 95% CI = 0.57–3.15, $p = 0.496$). Collectively, these findings indicate that MCI in this population is influenced by the interplay of sociodemographic disadvantages, physical inactivity, psychosocial adversity, and limited cognitive engagement, whereas MCI knowledge alone was not an independent predictor.

The overall performance of the multivariable logistic regression model was acceptable. The Omnibus Test of Model Coefficients indicated that the full model provided a significantly better fit than the null model ($\chi^2 = 211.446$, $df = 24$, $p < 0.001$). The Hosmer–Lemeshow goodness-of-fit test indicated that the model fit the data well, with no significant discrepancy between the observed and predicted values ($\chi^2 = 6.360$, $df = 8$, $p = 0.607$). The Nagelkerke R^2 value of 0.551 indicated that the model accounted for approximately 55.1% of the variance in MCI status, while the Cox and Snell R^2 value was 0.400.

Table 3 Factors associated with mild cognitive impairment among urban-dwelling older adults ($n = 414$)

Variables	Univariable logistic regression			Multivariable logistic regression		
	COR	95% CI	p -value	AOR	95% CI	p -value
Age (Years)						
60-69	1.00			1.00		
70-79	12.27	5.88-25.60	< 0.001	15.53	6.43-37.52	$< 0.001^*$
80 or older	14.22	6.33-31.94	< 0.001	21.96	9.09-53.05	$< 0.001^*$
Gender						
Male	1.00			1.00		
Female	1.15	0.77-1.73	0.489	1.34	0.68-2.64	0.395
Education level						
Below secondary education	2.94	1.72-5.03	< 0.001	2.49	1.11-5.57	0.026*
Secondary education or above	1.00			1.00		
Marital status						
Single/ Widowed/Divorced/Separated	1.17	0.76-1.79	0.470	1.08	0.55-2.13	0.824
Married	1.00			1.00		
Occupation						
Employed	1.00			1.00		
Unemployed	4.34	2.61-7.19	< 0.001	5.18	2.50-10.76	$< 0.001^*$
Monthly income (THB)						
0-5,000	1.06	0.69-1.60	0.785	2.23	1.12-4.46	0.023*
>5,000	1.00			1.00		
Living arrangement						
Living alone	1.29	0.67-2.49	0.436	1.81	0.59-5.56	0.299
Living with other	1.00			1.00		

Table 3 Cont.

Variables	Univariable logistic regression			Multivariable logistic regression		
	COR	95% CI	<i>p</i> -value	AOR	95% CI	<i>p</i> -value
Health conditions						
No	1.00			1.00		
Yes	1.88	1.16-3.04	0.010	1.80	0.63-5.11	0.271
Daily medication use						
Non-polypharmacy	1.00			1.00		
Polypharmacy	1.19	0.78-1.81	0.413	1.03	0.41-2.57	0.944
Fall history in the past 12 months						
No	1.00			1.00		
Yes	1.48	0.89-2.43	0.136	1.95	0.87-4.38	0.105
Visual impairment						
No	1.00			1.00		
Yes	1.56	1.00-2.43	0.050	1.13	0.60-2.14	0.703
Hearing impairment						
No	1.00			1.00		
Yes	1.45	0.91-2.31	0.121	1.54	0.71-3.32	0.271
Physical activity						
None	1.71	1.11-2.62	0.014	2.45	1.30-4.61	0.005*
Mild/Regularly	1.00			1.00		
Sleep duration (hours/night)						
<8	1.58	1.02-2.45	0.042	1.95	0.99-3.83	0.052
≥8	1.00			1.00		
Smoking status						
No	1.00			1.00		
Yes	1.10	0.65-1.85	0.728	1.14	0.46-2.82	0.780
Alcohol consumption						
Non-drinker	1.00			1.00		
Drinker	1.26	0.75-2.10	0.382	1.37	0.58-3.20	0.467
Depression by PHQ-9						
No depression	1.00			1.00		
Has depression	4.36	2.60-7.29	< 0.001	8.63	3.56-20.92	< 0.001*
Stress by ST-5						
Minimal stress	1.00			1.00		
Moderate/ High stress	2.54	1.47-4.37	< 0.001	3.91	1.68-9.05	0.001*
Community and social activity participation						
Inactive	1.65	1.09-2.51	0.019	3.07	1.61-5.85	< 0.001*
Active	1.00			1.00		
Social support						
No	1.32	0.72-2.41	0.377	1.17	0.45-3.05	0.745
Yes	1.00			1.00		
Knowledge of MCI						
Low/Moderate	2.44	1.40-4.24	0.002	1.34	0.57-3.15	0.496
High	1.00			1.00		
Smartphone and technology use						
Non-user	1.61	1.06-2.45	0.026	1.41	0.73-2.70	0.301
User	1.00			1.00		
Brain-training activity participation						
Inactive	3.88	2.28-6.60	< 0.001	3.99	1.81-8.82	< 0.001*
Active	1.00			1.00		

Note: Associations were assessed using univariable and multivariable logistic regression; 1.00 indicates the reference group. COR = crude odds ratio; AOR = adjusted odds ratio; CI = confidence interval; PHQ-9 = Patient Health Questionnaire-9; ST-5 = Stress Test-5; MCI = mild cognitive impairment. *Statistical significance $p < 0.05$.

5. Discussion

5.1 Prevalence of MCI among Urban-Dwelling Older Adults

This study found that 35.0% of community-dwelling older adults in an urban area of Pathum Thani Province had MCI, as assessed using the TMSE. Within Thailand, Srisupornkornkool et al. (2022) reported a comparable prevalence of 34.2% in urban Phitsanulok using a similar screening approach, while Griffiths (2020) documented a prevalence of approximately 36% in rural northern Thailand using the Mini-Mental State Examination (MMSE). Similar findings have been reported in other Thai populations, including 33.95% among adults aged 30–65 years in Chiang Mai (Pinyopornpanish et al., 2024) and 35.6% in a rural Chiang Mai cohort (Kitro et al., 2024), both of which closely align with the present estimate. Comparable prevalence rates have also been observed internationally, including 35.1% in Chennai (Rajesh et al., 2020), 36.7% in South India (Diwakar et al., 2025), and 37.3% in Palestine (Hamdan et al., 2025). It should be noted that studies using the Montreal Cognitive Assessment (MoCA) consistently report substantially higher prevalence estimates, typically ranging from 71% to 85%, reflecting the instrument's greater sensitivity compared with the TMSE (Ciesielska et al., 2016). Therefore, the 35.0% prevalence observed in the present study represents a TMSE-based screening estimate and should not be directly compared with prevalence estimates derived from MoCA-based assessments.

The prevalence observed in this study may reflect the demographic and socioeconomic characteristics of the sample, which included a substantial proportion of middle-old and oldest-old adults, age groups in which the prevalence of MCI increases markedly (Xue et al., 2018). Socioeconomic disadvantages, including low educational attainment and limited income, may further contribute by reducing cognitive stimulation and access to preventive care (Livingston et al., 2024). In addition, the peri-urban context may predispose individuals to sedentary behavior, psychosocial stress, and reduced social cohesion (Zhang et al., 2025). Moreover, the high burden of vascular comorbidities, including hypertension, hyperlipidemia, and diabetes mellitus, may contribute to cognitive decline through cumulative cerebrovascular damage and related neurovascular changes (Livingston et al., 2024). Collectively, these factors may account for the observed prevalence and emphasize the need for targeted cognitive screening in this population. Nevertheless, the TMSE cut-off score

of ≤ 23 is not formally equivalent to the Petersen clinical criteria for MCI, and individuals with cognitive underperformance due to low educational attainment or sensory impairment may be misclassified, potentially inflating the prevalence estimate.

5.2 Determinants of MCI among Urban-Dwelling Older Adults

5.2.1 Sociodemographic Domain

In this study, advancing age emerged as the strongest independent predictor of MCI, with markedly higher risk among middle-old and oldest-old adults than among those in the young-old group. This finding is consistent with previous research conducted in Thailand and neighboring countries. Kitro et al. (2024) similarly reported that age was a significant predictor of MCI among community-dwelling older adults, while Tiraphat and Aekplakorn (2018) documented that the likelihood of cognitive impairment increased substantially with advancing age across both urban and rural Thai populations. From a biological perspective, this association may be attributable to the cumulative accumulation of neurodegenerative changes, including an increased burden of white matter lesions, declining synaptic density, and the compounding effects of vascular pathology on cognitive function in later life (Livingston et al., 2024). As Thailand's middle-old and oldest-old populations continue to expand, advancing age will remain the most consistent non-modifiable determinant of MCI risk in this setting.

An educational attainment below the secondary level was associated with MCI. This finding corroborates evidence from several community-based studies in Thailand and the broader Asian region, including Nanthakwang et al. (2020), who reported that illiteracy was associated with MCI among older adults in northern Thailand, and Mon et al. (2017), who found that low educational attainment substantially increased the risk of MCI. Cognitive reserve theory provides a compelling explanation for this relationship: greater formal education is thought to promote higher synaptic density, more efficient neural networks, and stronger compensatory capacity against age-related neuropathological changes, thereby delaying the clinical manifestation of cognitive impairment (Livingston et al., 2024). Conversely, older adults with limited formal education may have insufficient cognitive reserve to compensate for neurodegeneration, making them more susceptible to measurable cognitive decline.

Unemployment was also associated with MCI in this study. This finding is consistent with Chung and Kim (2020), who demonstrated that disengagement from employment was significantly associated with an increased risk of MCI among older workers. Paid employment may support cognitive health through several mechanisms, including routine intellectual stimulation, structured social interaction, a sense of purpose, and financial security, all of which contribute to the development and maintenance of cognitive reserve (Takase et al., 2024). Among older adults in this urban setting, retirement or job loss may reduce opportunities for mental stimulation and purposeful social engagement, thereby accelerating cognitive deterioration. However, the substantially elevated odds ratio associated with unemployment warrants cautious interpretation. A bidirectional relationship is possible, whereby progressive cognitive decline may itself impair occupational functioning and ultimately lead to withdrawal from the workforce, rather than unemployment serving solely as an antecedent determinant of cognitive deterioration.

Low monthly income was associated with an increased likelihood of MCI. Auampradit et al. (2019) similarly found that economic disadvantage was associated with a higher risk of cognitive impairment among Thai older adults in the Kanchanaburi cohort, while Muhammad et al. (2022) reported that low perceived income sufficiency was an independent correlate of cognitive impairment in India. Financial hardship may restrict access to cognitively stimulating activities, adequate nutrition, and preventive healthcare, while chronic economic stress may generate allostatic load that adversely affects hippocampal structure and neurobiological function over time (Livingston et al., 2024). Notably, the crude association between monthly income and MCI was not statistically significant (COR = 1.06, 95% CI: 0.69–1.60, $p = 0.785$), whereas the association became significant after adjustment for other covariates (AOR = 2.23, 95% CI: 1.12–4.46, $p = 0.023$). This pattern suggests a suppression effect, whereby the true association between income and MCI was masked in the unadjusted analysis by confounding factors such as age, education, or occupation, and became apparent only after these variables were statistically controlled.

5.2.2 Physical Health and Behavioral Domain

Physical inactivity was associated with MCI in this study. This finding aligns with Kitro et al. (2024), who reported that regular exercise was significantly protective against MCI among older adults in rural

Thailand. A global meta-analysis by Cai et al. (2023) also found that physical inactivity was associated with substantially higher odds of MCI. Mechanistically, regular exercise upregulates brain-derived neurotrophic factor (BDNF), which promotes neurogenesis, strengthens synaptic plasticity, and supports amyloid-beta clearance. Together, these processes help preserve hippocampal integrity and cognitive function (Livingston et al., 2024). The elevated prevalence of physical inactivity in this urban sample may reflect the limited availability of affordable, accessible, and structured physical activity programs in the peri-metropolitan setting of Pathum Thani.

Notably, health condition status was not associated with MCI after multivariable adjustment. This finding differs from that of Griffiths (2020), who identified diabetes mellitus as a significant independent predictor in a comparable Thai cohort, as well as from the broader literature linking vascular comorbidities to cognitive decline (Livingston et al., 2024; Biessels & Despa, 2018). Two methodological factors may account for this discrepancy. First, chronic disease status was operationalized as a single dichotomous variable, combining conditions with distinct cognitive pathways and thereby reducing disease-specific sensitivity. Second, biochemical markers such as Hemoglobin A1c (HbA1c), blood pressure, and lipid profiles were not collected, precluding assessment of disease control and duration, which may be more directly related to cognitive risk than diagnosis alone (Biessels & Despa, 2018).

5.2.3 Psychosocial Domain

Depression was the factor most strongly associated with MCI. This finding is consistent with a broad body of evidence from diverse populations. Chuang et al. (2021) demonstrated that depressive symptoms were independently associated with MCI among urban-dwelling older adults in Taiwan. The 2024 Lancet Commission on Dementia Prevention identified depression as one of 14 key modifiable risk factors for dementia and noted that late-life depression is associated with an approximately twofold increase in dementia risk (Livingston et al., 2024). Neurobiologically, depression may contribute to cognitive deterioration through glucocorticoid-mediated hippocampal atrophy, impaired Brain-Derived Neurotrophic Factor (BDNF) signaling, neuroinflammatory processes, and shared cerebrovascular injury. Conversely, early MCI may present with or exacerbate depressive symptoms,

suggesting a bidirectional relationship (Ismail et al., 2017). Given its substantial effect size and modifiable nature, depression represents a high-priority intervention target for MCI prevention in this population.

Moderate-to-high perceived stress was independently associated with MCI. This finding is consistent with Koyanagi et al. (2019), who reported that elevated perceived stress was significantly associated with increased odds of MCI. Biologically, chronic stress activates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in prolonged glucocorticoid secretion that suppresses hippocampal neurogenesis, reduces synaptic plasticity, and accelerates cognitive decline (James et al., 2023). Among older adults in this urban community, the co-occurrence of financial strain, functional loss, and diminished social support may create a compounded stress burden that further increases cognitive vulnerability.

Non-participation in community and social activities was associated with MCI. This finding aligns with Smith et al. (2022), who demonstrated that social participation was associated with a lower risk of cognitive impairment. Active community participation is believed to protect cognitive function by providing ongoing intellectual stimulation, emotional support, stress regulation, and a reinforced sense of personal identity and purpose, collectively contributing to the development of cognitive reserve (Livingston et al., 2024). The elevated rate of social inactivity in this urban sample may reflect the erosion of community ties in rapidly urbanizing settings, a lack of organized activities accessible to older residents, and competing demands such as family caregiving responsibilities (Piyaphattanuschai & Chuaktong, 2025). The bidirectional nature of this association should also be considered, as diminished cognitive capacity may itself reduce the motivation and ability to participate in social and community activities.

5.2.4 Cognitive Engagement Domain

Non-participation in brain-training activities was associated with MCI. This finding is supported by Kunrit et al. (2025), who demonstrated that a game-based cognitive exercise program led to significant improvements in TMSE scores among older adults with MCI, while Phanasathit et al. (2022) reported clinically meaningful cognitive improvements following low-technology cognitive training in a randomized trial among community-dwelling Thai older adults. Regular participation in structured cognitive activities, including puzzles, memory

training, and digital brain exercises, is thought to maintain neural efficiency, reinforce task-specific synaptic connections, and slow progression from MCI to dementia through cognitive reserve mechanisms. Structural barriers, including limited program availability and low community awareness of cognitive health promotion, represent key modifiable targets for intervention in this urban setting. The bidirectional nature of this association should also be acknowledged, as declining cognitive function may itself reduce the capacity and motivation to participate in brain-training activities.

5.2.5 Knowledge of MCI Domain

Knowledge of MCI was not associated with cognitive status after covariate adjustment, despite a significant crude association. This finding is consistent with health literacy theory, which holds that knowledge is a prerequisite for protective action but is insufficient on its own without adequate self-efficacy, social support, and access to enabling resources (Nutbeam, 2000; Pender et al., 2015). The well-documented knowledge-behavior gap may explain this pattern, as structural constraints such as financial hardship, limited program availability, and low perceived capability may prevent knowledge from being translated into behavior (Dong et al., 2026; Reamrimmadun et al., 2025). These findings indicate that cognitive health promotion should extend beyond information dissemination to include enabling environments and behavioral activation strategies.

5.3 Limitations

This study has several methodological limitations that should be acknowledged. First, because it employed a cross-sectional design, causal or temporal relationships between the identified factors and MCI status could not be established. Second, selection bias may have affected the sample, as recruitment through community health registries and VHV networks may have underrepresented older adults with severe cognitive decline or social isolation. Third, reliance on self-reported data for behavioral and psychosocial variables may have introduced recall and social desirability bias. Fourth, cognitive status was assessed using the TMSE rather than a comprehensive neuropsychological battery, and the instrument does not differentiate among MCI subtypes.

Furthermore, the TMSE cut-off score of ≤ 23 is not formally equivalent to the Petersen clinical criteria for MCI, and misclassification among individuals

with low educational attainment or sensory impairment may have inflated the observed prevalence estimate. Therefore, the TMSE-based classification reflects a cognitive screening rate rather than the prevalence of clinically confirmed MCI. In addition, MoCA-based studies report substantially higher prevalence estimates, and the present estimate is not directly comparable with those derived using other instruments because of differences in sensitivity. Fifth, because the data were collected from only one urban district in a single central Thai province, the findings may not be generalizable to other cities, geographic regions, or rural populations. Residual confounding may also remain because several factors were not measured, including genetic susceptibility, lifelong cognitive reserve, and more detailed nutritional and environmental exposures.

5.4 Policy and Clinical Practice Implications for Public Health

These findings have important implications for both public health policy and clinical practice. First, routine community-based cognitive screening should be expanded and strengthened at the district and subdistrict levels. Second, health promotion interventions should target the modifiable risk factors most strongly associated with MCI in this study, namely depression, psychological stress, physical inactivity, non-participation in brain-training activities, and social disengagement. Mental health screening, cognitive stimulation, and structured social activities should be integrated into primary care services. Third, the VHV network should be systematically leveraged to support cognitive health surveillance, early referral pathways, and peer support. Finally, the knowledge-behavior gap observed in this study, whereby high levels of MCI knowledge did not independently protect against MCI, suggests that health promotion efforts should shift from information dissemination toward the development of enabling environments and behavioral activation.

5.5 Future Research Recommendations

Future studies should employ longitudinal designs with a minimum follow-up period of three to five years to establish causal pathways and determine whether early intervention reduces the rate of progression from MCI to dementia. Multisite comparative studies involving urban and rural Thai populations are needed to strengthen external validity and inform national health policy. Mixed-methods

approaches incorporating qualitative inquiry into older adults' subjective experiences of cognitive change, coping strategies, and barriers to healthcare engagement would complement quantitative epidemiological findings and provide deeper contextual insight. Finally, randomized or quasi-experimental intervention studies are needed to evaluate the effectiveness of depression treatment, brain-training programs, and social engagement interventions for at-risk older adults in community settings across Thailand.

6. Conclusion

This study demonstrates that MCI is highly prevalent among community-dwelling older adults in an urban area of Pathum Thani Province, Thailand, with 35.0% of participants classified as having MCI. This figure is consistent with prevalence estimates reported in other Thai urban and rural communities and underscores the scale of the need for targeted public health action. Nine independently associated factors were identified: advancing age, low educational attainment, unemployment, low income, physical inactivity, depression, psychosocial stress, social disengagement, and non-participation in brain-training activities. Collectively, these findings support the multidomain etiology of MCI and indicate that several contributing factors are modifiable, thereby presenting meaningful opportunities for preventive intervention. Strengthening community-based cognitive screening, integrating mental health and cognitive stimulation services into primary care, and strategically deploying the VHV network are recommended as priority actions within Thailand's existing health infrastructure. Future studies should use longitudinal and intervention-based designs to clarify causal mechanisms and evaluate the effectiveness of MCI prevention strategies in community settings.

7. Acknowledgements

The authors sincerely thank all older adults in the urban communities of Pathum Thani Province for their willingness to participate in this study. We are grateful to the Pathum Thani Provincial Public Health Office and the Director of Khlong Luang Hospital for granting permission and providing institutional support throughout the data collection process. We also extend our appreciation to the VHV, local health officers, and community health center staff for their invaluable assistance with participant recruitment and data collection.

8. Funding

This research was funded by Valaya Alongkorn Rajabhat University under the Royal Patronage and supported by the Thailand Science, Research and Innovation (TSRI) through the Fundamental Fund, fiscal year 2025 (Grant No. VRU-FF68/019).

9. Abbreviations

Abbreviation	Full Term
AOR	Adjusted Odds Ratio
BDNF	Brain-Derived Neurotrophic Factor
CI	Confidence Interval
COR	Crude Odds Ratio
HbA1c	Hemoglobin A1c
HPA	Hypothalamic-pituitary-adrenal
IOC	Index of Item-Objective Congruence
IRB	Institutional Review Board
KR-20	Kuder–Richardson Formula 20
MCI	Mild Cognitive Impairment
MMSE	Mini-Mental State Examination
MoCA	Montreal Cognitive Assessment
PHQ-9	Patient Health Questionnaire-9
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
ST-5	Stress Test-5
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
THB	Thai Baht
TMSE	Thai Mental State Examination
TSRI	Thailand Science, Research and Innovation
VHV	Village Health Volunteers
VIF	Variance Inflation Factor

10. CRediT Statement

Phannathat Tanthanapanyakorn: Conceptualization, Methodology, Validation, Formal Analysis, Statistical Analysis, Investigation, Data Curation, Writing – Original Draft. ORCID: <https://orcid.org/0009-0006-7825-2429>

Nonlapan Khantikulanon: Conceptualization, Methodology, Formal Analysis, Investigation, Resources, Data Curation, Visualization. ORCID: <https://orcid.org/0009-0003-4460-3620>

Tassanapan Weschasat: Conceptualization, Validation, Investigation, Resources, Supervision,

Formal Analysis, Statistical Analysis, Data Curation. ORCID: <https://orcid.org/0009-0008-8451-5162>

Sootthikarn Mungkhunthod: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Project Administration, Writing – Original Draft, Writing – Review & Editing. ORCID: <https://orcid.org/0009-0009-1185-0274>

11. References

- Alzheimer's Association. (2024). 2024 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 20(5), 3708-3821. <https://doi.org/10.1002/alz.13809>
- Auampradit, N., Vapattanawong, P., Punpuing, S., Sunpuwan, M., & Jirapramukpitak, T. (2019). A longitudinal study of changes in cognition among older Thais: Studying from the Kanchanaburi demographic surveillance system. *Gerontology and Geriatric Medicine*, 5, Article 2333721419862885. <https://doi.org/10.1177/2333721419862885>
- Biessels, G. J., & Despa, F. (2018). Cognitive decline and dementia in diabetes mellitus: Mechanisms and clinical implications. *Nature Reviews Endocrinology*, 14(10), 591-604. <https://doi.org/10.1038/s41574-018-0048-7>
- Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain*. New York, US: Longman.
- Cai, X. Y., Qian, G. P., Wang, F., Zhang, M. Y., Da, Y. J., & Liang, J. H. (2023). Association between sedentary behavior and risk of cognitive decline or mild cognitive impairment among the elderly: A systematic review and meta-analysis. *Frontiers in Neuroscience*, 17, Article 1221990. <https://doi.org/10.3389/fnins.2023.1221990>
- Chuang, Y. F., Liu, Y. C., Tseng, H. Y., Lin, P. X., Li, C. Y., Shih, M. H., ... & Chiu, Y. L. (2021). Urban-rural differences in the prevalence and correlates of mild cognitive impairment in community-dwelling older adults in Taiwan: The EMCIT study. *Journal of the Formosan Medical Association*, 120(9), 1749-1757. <https://doi.org/10.1016/j.jfma.2021.03.005>
- Chung, W., & Kim, R. (2020). Differential risk of cognitive impairment across paid and unpaid occupations in the middle-age population: Evidence from the Korean Longitudinal Study

- of Aging, 2006–2016. *International Journal of Environmental Research and Public Health*, 17(9), Article 3124.
<https://doi.org/10.3390/ijerph17093124>
- Ciesielska, N., Sokołowski, R., Mazur, E., Podhorecka, M., Polak-Szabela, A., & Kędziora-Kornatowska, K. (2016). Is the Montreal Cognitive Assessment (MoCA) test better suited than the Mini-Mental State Examination (MMSE) in mild cognitive impairment (MCI) detection among people aged over 60? Meta-analysis. *Psychiatria Polska*, 50(5), 1039-1052.
<https://doi.org/10.12740/PP/45368>
- Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). New York, US: John Wiley & Sons.
- Dahlgren, G., & Whitehead, M. (1991). *Policies and strategies to promote social equity in health: Background document to WHO—Strategy paper for Europe* (Arbetsrapport 2007:14). Institute for Futures Studies. Retrieved from https://ideas.repec.org/p/hhs/ifswps/2007_014.html
- Department of Mental Health. (2009). *ST-5 stress assessment*. Retrieved from <https://dmh.go.th/test/>
- Department of Older Persons, Ministry of Social Development and Human Security. (2025). *Situation of the Thai Older Persons*. Retrieved from https://www.dop.go.th/download/statistics/th1768287262-2583_1.pdf
- Diwakar, R., Chakravarthy, B. S., Peter, R. M., Palanisamy, K., & Anantharaman, V. V. (2025). Prevalence of cognitive impairment and its determinants among older adults in Urban South India—A cross-sectional study. *Nigerian Postgraduate Medical Journal*, 32(4), 376-382.
https://doi.org/10.4103/npmj.npmj_148_25
- Dong, J., Yu, S., Qin, Y., Jin, X., Xing, Y., & Wang, H. (2026). Knowledge and health beliefs about dementia prevention among Chinese older adults: A qualitative study. *Qualitative Health Research*, 36(4-5), 405-427.
<https://doi.org/10.1177/10497323251324127>
- Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, 196(4286), 129-136.
<https://doi.org/10.1126/science.847460>
- Fowler, N. R., Partrick, K. A., Taylor, J., Hornbecker, M., Kelleher, K., Boustani, M., ... & Willis, D. R. (2025). Implementing early detection of cognitive impairment in primary care to improve care for older adults. *Journal of Internal Medicine*, 298(1), 31-45.
<https://doi.org/10.1111/joim.20098>
- Griffiths, J. (2020). *Prevalence and factors associated with mild cognitive impairment among older adults in rural communities of northern Thailand* [Doctoral dissertation], Chiang Mai University, Thailand.
- Hamdan, M., Zidan, S., Abualhaija, R., Vanoh, D., Mouamer, A., Taqatqa, H., ... & Badrasawi, M. (2025). Factors associated with mild cognitive impairment among Palestinian community-dwelling older adults: A cross-sectional study. *Cogent Psychology*, 12(1), Article 2478715.
<https://doi.org/10.1080/23311908.2025.2478715>
- Ismail, Z., Elbayoumi, H., Fischer, C. E., Hogan, D. B., Millikin, C. P., Schweizer, T., ... & Fiest, K. M. (2017). Prevalence of depression in patients with mild cognitive impairment: A systematic review and meta-analysis. *JAMA Psychiatry*, 74(1), 58-67.
<https://doi.org/10.1001/jamapsychiatry.2016.3162>
- James, K. A., Stromin, J. I., Steenkamp, N., & Combrinck, M. I. (2023). Understanding the relationships between physiological and psychosocial stress, cortisol and cognition. *Frontiers in Endocrinology*, 14, Article 1085950.
<https://doi.org/10.3389/fendo.2023.1085950>
- Kitro, A., Panumasvivat, J., Sirikul, W., Wijitraphan, T., Promkutkao, T., & Sapbamrer, R. (2024). Associations between frailty and mild cognitive impairment in older adults: Evidence from rural Chiang Mai Province. *PLoS One*, 19(4), Article e0300264.
<https://doi.org/10.1371/journal.pone.0300264>
- Koyanagi, A., Oh, H., Vancampfort, D., Carvalho, A. F., Veronese, N., Stubbs, B., & Lara, E. (2019). Perceived stress and mild cognitive impairment among 32,715 community-dwelling older adults across six low-and middle-income countries. *Gerontology*, 65(2), 155-163. <https://doi.org/10.1159/000492177>
- Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16(9), 606-613.
<https://doi.org/10.1046/j.1525-1497.2001.016009606.x>

- Kunrit, P., Tanthanapanyakorn, P., Khantikulanon, N., Mungkhunthod, S., Praserttai, C., Rungrungrueang, S., & Phonmamuang, W. (2025). Effectiveness of a brain exercise program using game-based cognitive enhancement to reduce mild cognitive impairment among older adults in Pathum Thani Province, Thailand: A quasi-experimental study. *Osong Public Health and Research Perspectives*, 16(1), 59-71. <https://doi.org/10.24171/j.phrp.2024.0267>
- Livingston, G., Huntley, J., Liu, K. Y., Costafreda, S. G., Selbæk, G., Alladi, S., ... & Mukadam, N. (2024). Dementia prevention, intervention, and care: 2024 report of the Lancet standing Commission. *The Lancet*, 404(10452), 572-628. [https://doi.org/10.1016/S0140-6736\(24\)01296-0](https://doi.org/10.1016/S0140-6736(24)01296-0)
- Lotrakul, M., Sumrithe, S., & Saipanish, R. (2008). Reliability and validity of the Thai version of the PHQ-9. *BMC Psychiatry*, 8(1), Article 46. <https://doi.org/10.1186/1471-244X-8-46>
- Mahoney, F., & Barthel, D. (1965). Functional evaluation: The Barthel Index. *Maryland State Medical Journal*, 14, 61-65.
- Mon, S. L., Tiraphat, S., & Jayasvasti, I. (2017). Factors associated with mild cognitive impairment among the community-dwelling elderly in the urban area of Kyauk Tan Township, Myanmar. *Journal of Public Health and Development*, 15(1), 63-79.
- Muhammad, T., Srivastava, S., & Sekher, T. V. (2022). Assessing socioeconomic inequalities in cognitive impairment among older adults: A study based on a cross-sectional survey in India. *BMC Geriatrics*, 22(1), Article 389. <https://doi.org/10.1186/s12877-022-03076-6>
- Nanthakwang, N., Siviroj, P., Matanasarawoot, A., Sapbamrer, R., Lerttrakarnnon, P., & Awiphan, R. (2020). Prevalence and associated factors of cognitive impairment and poor sleep quality among community-dwelling older adults in Northern Thailand. *The Open Public Health Journal*, 13, 815-822. <https://doi.org/10.2174/1874944502013010815>
- National Statistical Office. (2023). *Survey of the older persons in Thailand*. Retrieved from https://www.nso.go.th/nsoweb/nso/survey_detail/iM?set_lang=en
- Nutbeam, D. (2000). Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health promotion international*, 15(3), 259-267. <https://doi.org/10.1093/heapro/15.3.259>
- Pender, N. J., Murdaugh, C. L., & Parsons, M. A. (2015). *Health promotion in nursing practice* (7th ed.). New Jersey, US: Pearson Education, Inc.
- Petersen, R. C. (2004). Mild cognitive impairment as a diagnostic entity. *Journal of Internal Medicine*, 256(3), 183-194. <https://doi.org/10.1111/j.1365-2796.2004.01388.x>
- Phanasathit, M., Nimnuan, C., & Lohsoonthorn, V. (2022). The effects of cognitive training in healthy community residing Thai elderly: A randomized controlled trial. *Psychology Research and Behavior Management*, 15, 3709-3720. <https://doi.org/10.2147/PRBM.S383526>
- Pinyopornpanish, K., Buawangpong, N., Soontornpun, A., Thaikla, K., Pateekhum, C., Nantsupawat, N., ... & Angkurawaranon, C. (2024). A household survey of the prevalence of subjective cognitive decline and mild cognitive impairment among urban community-dwelling adults aged 30 to 65. *Scientific Reports*, 14(1), Article 7783. <https://doi.org/10.1038/s41598-024-58150-3>
- Piyaphattanuschai, T., & Chuaktong, S. (2025). The effect of the resilience quotient program with social support among the elderly with chronic non-communicable diseases. *Journal of Current Science and Technology*, 15(4), Article 130. <https://doi.org/10.59796/jcst.V15N4.2025.130>
- Rajesh, J., Ramasubramanian, R., & Santhanam, R. S. (2020). A Cross-sectional study on prevalence of cognitive impairment and its associated factors among the elderly in an urban area of Chennai, India. *International Journal of Community Medicine and Public Health*, 7(12), 5126-5133. <https://doi.org/10.18203/2394-6040.ijcmph20205196>
- Reamrimmadun, Y., Jaidee, W., Wattanaburanon, A., & Rojpaisarnkit, K. (2025). Effectiveness of a web-based application on health literacy, self-efficacy, self-care, and glycemic control in elderly patients with type 2 diabetes: A randomized controlled trial. *Journal of Current Science and Technology*, 15(1),

- Article 83.
<https://doi.org/10.59796/jcst.V15N1.2025.83>
- Smith, L., Shin, J. I., Sánchez, G. F. L., Oh, H., Kostev, K., Jacob, L., ... & Koyanagi, A. (2022). Social participation and mild cognitive impairment in low-and middle-income countries. *Preventive Medicine*, 164, Article 107230.
<https://doi.org/10.1016/j.ypmed.2022.107230>
- Srisupornkornkool, K., Veerapan, O., Thwon, K., Supain, B., Ponriangpon, A., Boonyarom, O., & Somthavil, S. (2022). Prevalence and factors related to mild cognitive impairment in older adults at Muang District, Phitsanulok Province. *Journal of Health Science of Thailand*, 31(1), 14-26.
- Takase, M., Sugiura, K., Nakamoto, I., Watanabe, S., & Murayama, H. (2024). The association between employment and cognitive function in older adults: A systematic review. *Geriatrics & Gerontology International*, 24(12), 1283-1291.
<https://doi.org/10.1111/ggi.15017>
- Tiraphat, S., & Aekplakorn, W. (2018). Comparison of prevalence and risk factors associated with cognitive impairment between rural and urban elderly in Thailand. *Journal of the Medical Association of Thailand*, 101(3), 331-337.
- Train the Brain Forum Committee. (1993). Thai mental state examination (TMSE). *Siriraj Hospital Gazette*, 45(6), 359-374.
- United Nations. (2023). *World social report 2023: Leaving no one behind in an ageing world*. Retrieved from
<https://www.un.org/development/desa/dspd/world-social-report/2023-2.html>
- Von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *The Lancet*, 370(9596), 1453-1457.
[https://doi.org/10.1016/S0140-6736\(07\)61602-X](https://doi.org/10.1016/S0140-6736(07)61602-X)
- Wang, Y., Li, M., Houghton, D., & Kazis, L. E. (2024). Transition of mild cognitive impairment to Alzheimer's disease: Medications as modifiable risk factors. *PLoS One*, 19(8), Article e0306270.
<https://doi.org/10.1371/journal.pone.0306270>
- World Health Organization (WHO). (2022). *Ageing and health*. Retrieved from
<https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>
- Xue, J., Li, J., Liang, J., & Chen, S. (2018). The prevalence of mild cognitive impairment in China: A systematic review. *Ageing and Disease*, 9(4), 706-715.
<https://doi.org/10.14336/AD.2017.0928>
- Zhang, W., Zhang, J., & Gao, N. (2025). Social isolation and cognitive decline in older adults: A longitudinal study across 24 countries. *BMC Geriatrics*, 25(1), Article 775.
<https://doi.org/10.1186/s12877-025-06430-6>