Clinical Effectiveness Evaluation and Cost-effectiveness Analysis of Comprehensive Geriatric Assessment and Multidisciplinary Team for Ambulatory Older Patients: A Cohort Study

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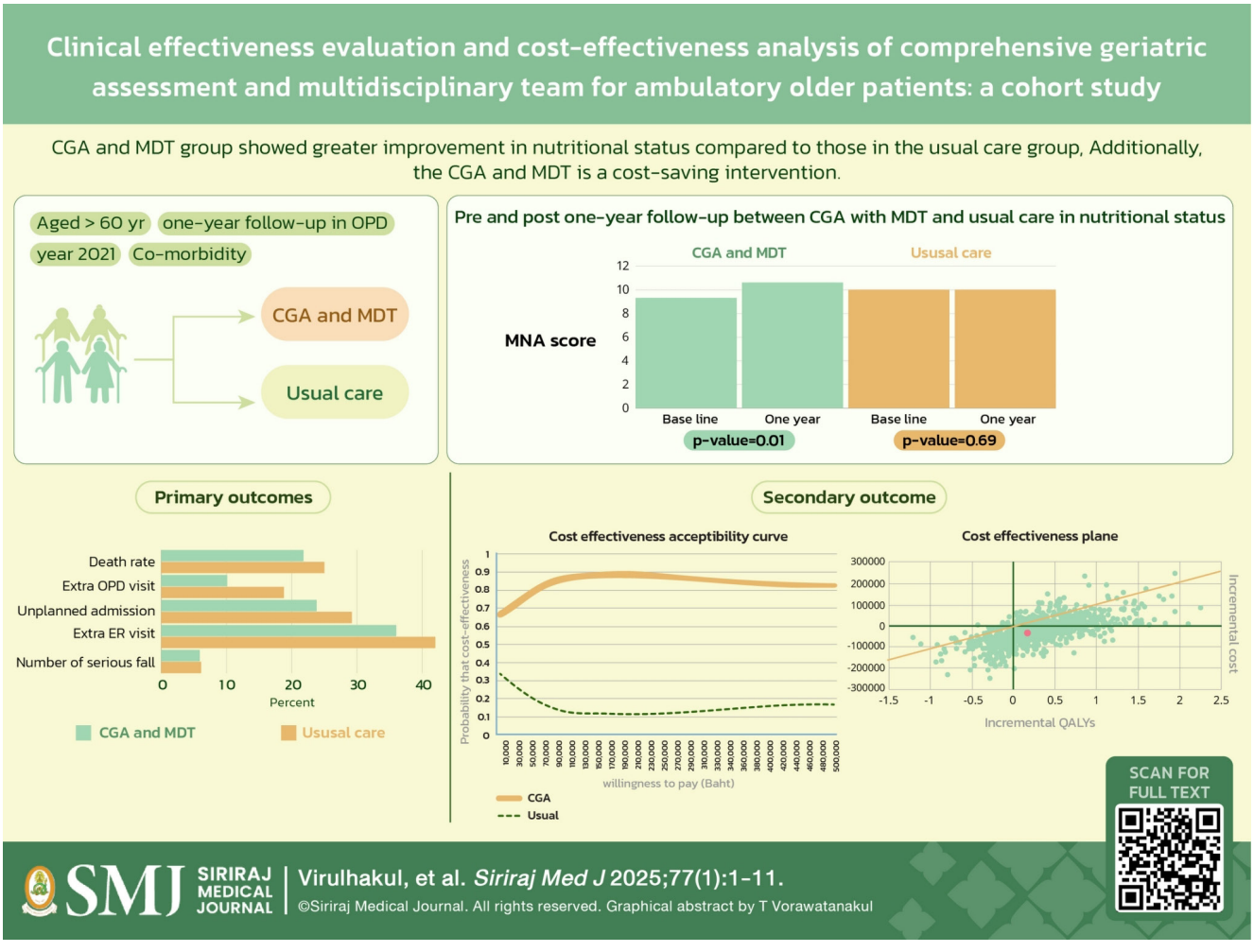

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ABSTRACT

Objective: The comprehensive geriatric assessment (CGA) and multidisciplinary team (MDT) services are essential components of clinics that promote holistic care for older patients. However, their clinical and cost-effectiveness have not been fully established.

Materials and Methods: This study was a 1-year cohort, two-arm observational study conducted in ambulatory older patients at the Geriatric and Internal Medicine OPD. The primary endpoint was clinical effectiveness: activity of daily living (ADL), Thai mental status examination (TMSE), Mini-nutritional assessment (MNA), extra-visit, hospitalization, length of stay, fall rate, and death rate. The secondary endpoint was a cost-utility analysis using a decision-tree and Markov model. Outcomes included the incremental cost-effectiveness ratio (ICER), and quality of life, assessed by the European Quality of Life Five Dimensions Five Levels (EQ-5D-5L). Sensitivity analysis was conducted through probabilistic methods.

Results: Older adults who received the CGA and MDT service in the geriatric OPD showed improved nutritional status, with the MNA-SF score increasing from 9.3 (± 3.3) to 10.9 (± 2.9) (p=0.01). There were no significant differences between groups in terms of extra-visits, hospitalizations, length of stay, fall rate, or death rate. After one year, the ICER for the CGA and MDT group was US$-3,073 per quality-adjusted life year (QALY) gained to usual care, indicating cost savings at a threshold of $4, 564.9 US dollar per QALY gained.

Conclusion: The CGA and MDT service in a geriatric clinic is clinically effective compared to usual care over a one-year follow-up, as demonstrated by the improvement in nutritional status. Additionally, the CGA and MDT is a cost-saving intervention.

Keywords: Clinical effectiveness evaluation; cost-effectiveness; incremental cost-effectiveness; comprehensive geriatric assessment; multidisciplinary team, geriatric clinic (Siriraj Med J 2025; 77: 1-11)

INTRODUCTION

Currently, the number of older adults is increasing significantly.[1] Older adults with comorbidity are considered a national healthcare challenge.[2,3] Evidence shows that patients who receive comprehensive geriatric assessment (CGA) and multidisciplinary team (MDT) services tend to live at home longer, have a reduced rate of institutionalization, receive more palliative care, and are prescribed safer, low-risk medications.[4-8] Studies in Europe and the US have found that CGA & MDT services improve clinical outcomes in over usual care in inpatient department (IPD) settings. However, these services in Western countries often incur high costs due to the extensive use of comprehensive service.[4,9-13] One study in Southeast Asia demonstrated that CGA and MDT services in an IPD setting can be both clinically effective and cost-saving for older adults.[14] It is necessary to evaluate clinical and cost-effectiveness[15] of CGA and MDT services in the Out-patient department (OPD) settings for older adults, as this has not yet been studied in Thailand or in tertiary hospitals worldwide.

MATERIALS AND METHODS

Study design

This study was a prospective cohort, 52-week trial with two parallel arms, conducted in the Geriatric OPD and Internal Medicine OPD at a tertiary hospital in Bangkok, Thailand. The study included both clinical and cost-effective analyses.

Cost-utility analysis was performed using a model-based approach (Decision Tree and Markov Model). The comparators were CGA and MDT versus usual care. The effectiveness was measured in life years (LY) and quality-adjusted life year (QALY). The study adopted a societal perspective, with a time horizon extending over length of life. Probabilistic sensitivity analysis was used as the analytic method.

Intervention and control

In the intervention group (CGA and MDT), older adults were patients who had previously received services in the Geriatric OPD. They underwent medical examinations and received treatment from a team of geriatricians and MDT, including a pharmacist, psychologist, geriatric nurse, dietitian, and rehabilitation team.

In the usual care group, older adults were patients who had previously received services in the Internal Medicine OPD. They received medical examinations and standard care from their doctors, who were either internists or specialist medicine physicians.

Participants and recruitment

The participants were older adults who met the following criteria: 1) aged 60 years or older with at least two comorbidities, 2) able to follow up at the hospital, and 3) had no communicable diseases. If participants were unable to provide personal history, a proxy or caregiver willing to participate in the study was asked to provide information instead. The exclusion criteria included older adults who: 1) had an unstable medical condition (ie sepsis, shock), 2) were expected to undergo surgery within 1 month, 3) had an accident which required immediate treatment within 24 hours, 4) were predicted to have a life expectancy < 6 months and 5) were not willing to participate in the research. All eligible older adults and their legal representatives were invited to participate in the study without undue influence and provided written informed consent.

Older adults visiting the Geriatric OPD and Internal Medicine OPD were randomly selected based on their OPD registration times: 8.00 AM, 9.00 AM, 10.00 AM, 11.00 AM, 1.00 PM, 2.00 PM, 3.00 PM. If a selected older adult did not meet the inclusion criteria, the next individual registered at that time was chose. The recruitment process was stratified by age and level of ADL. ADL evaluation included the Barthel Index, Lawton Scale, and ADL state.[16]

Procedures

The researcher conducted interviews with older adults. After obtaining informed consent, the researcher began by assessing their cognitive function using the Thai mental status examination (TMSE) test. The total score is 30 and the cut-off value for possible cognitive impairment is 23 or less. It includes assessment in orientation, memory, attention, calculation, language ability, picture copying, and abstract thinking. If the patients were diagnosed or showed symptoms of dementia and had a TMSE score ≤ 23 points, baseline characteristics, including age, gender, education level, Barthel ADL score, Lawton IADL score, Charlson comorbidity index, Utility (EQ5D5L), MNA short form, number of falls within 3 months, underlying diseases, and history of recent hip fracture were gathered from their caregiver or proxy.

The second and third interviews were conducted at the 6th month and 12th months, respectively. Phone interviews were used to collect cost-related information at the 3rd and 9th months. Onsite interviews at the 6th and 12th months were carried out to collect both clinical and cost data. Permission was requested from the hospital database department to access medical staff salaries for both the CGA and MDT and usual care groups to calculate direct medical costs.

At the beginning (day 0), and again at the 6th and 12th months, the researcher collected utility data by explaining the EQ-5D-5L scoring process to older adults or their caregivers before conducting the interview.

The analysis was performed at the 12-month mark to compare the clinical effectiveness and cost effectiveness between the two groups.

Outcomes

From the total of 138 older adults at the beginning of the study, the 55 older adults in CGA&MDT and 52 in usual care who remained at the one-year follow-up were analyzed (Fig 1).

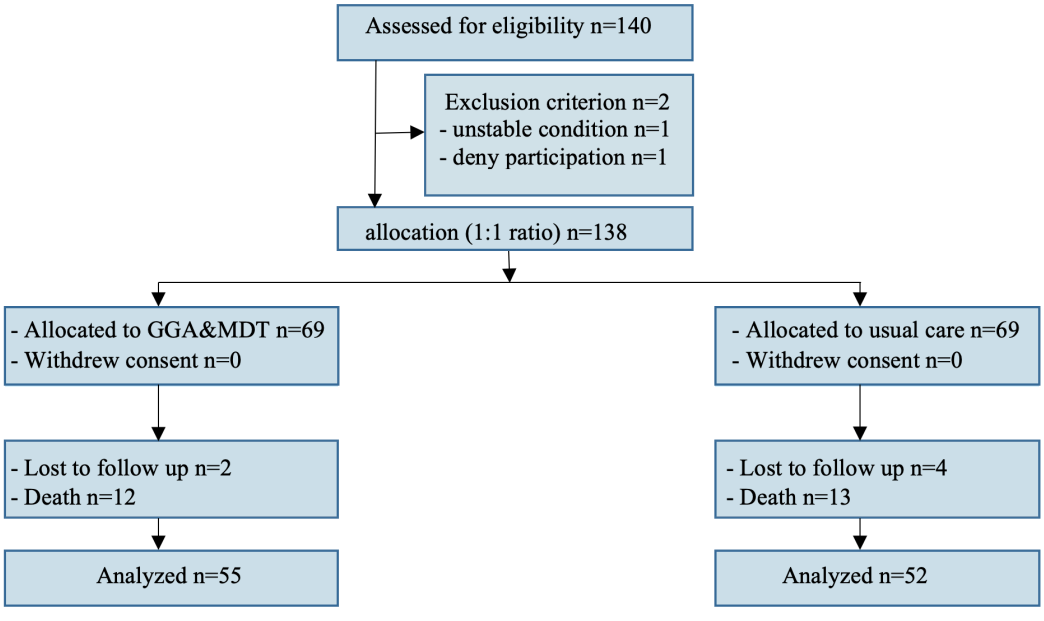

Fig 1. Study flowchart.
Abbreviations: CGA= comprehensive geriatric assessment, MDT=multidisciplinary team

Primary outcome

The primary outcome was the clinical effectiveness assessed across five aspects; 1. ADL consisting of the Barthel Index, Lawton Scale and ADL state[16], 2. Quality of life (QOL) and patient satisfaction, 3. Cognitive function assessed using TMSE, 4. Nutritional status evaluated using the MNA-SF, and 5. Unplanned hospitalizations, OPD visits, emergency department visits, length of hospital stays, fall events, and death rate.

The ADL was classified into five groups[17] as follows.

1. ADL 0: No ADL limitation
2. ADL 1: Mild ADL limitation
3. ADL 2: Moderate ADL limitation
4. ADL 3: Moderate ADL limitation
5. ADL 4: Complete ADL limitation

Given the study's one-year duration, the expected number of participant deaths was small. Therefore, the ADL state was used to predict the chance of death based on the study by Stineman MG.[15] The classification of ADL groups allowed for a one-year follow-up to match the ADL predictor with the possibility of death.[15] This information was then used to calculate, QALY, and incremental cost effectiveness ratio (ICER) in a decision tree diagram18 and Markov model.[19]

Secondary outcomes

The secondary outcomes included cost effectiveness in terms of the ICER. The intervention (CGA and MDT) cost and control (usual) cost were compared to assess both cost and QOL. ICER was evaluated to determine if adopting the new intervention is an efficient use of resources.

Costs were considered from a societal perspective, with a discount rate of 3%. Data were collected prospectively over a one-year period. The costs included direct medical costs, direct non-medical costs and indirect costs. Direct medical costs borne by patients were obtained from the hospital database, including medical services and personnel costs. The personnel cost was calculated by multiplying their hourly salary by the duration of service provided to each older adult. Direct non-medical costs included living expenses during the study, such as transportation, food and accommodation for healthcare visits. Costs covering expenses for drugs, transportation, food, accommodation, and medical devices for each older adult were collected and recorded in a logbook. Total costs for each older adult were computed by adding all medical costs listed in the parameter and utility table. The transitional ADL states and utility were obtained from evaluations at the 0^{th} and 12^{th} month evaluation for both groups. At the 0^{th} month, ADLs were classified into states 0 to IV; at the 12^{th} month, they were classified into states 0 to IV and death (within 12 months) (Supplementary Fig 1). The utility scores derived from the health-related quality of life measure (EQ-5D-5L) questionnaire were converted to a scale ranging from 0 to 1 (with lower scores indicating lower quality of life and higher scores indicating better quality of life). Though there are many QOL measures, we chose the EQ-5D-5L which is the generic, preference-based measure to generate QALYs for the cost-effective analysis. This questionnaire is completed with low burden to patients and readily applied in a various health setting. It covered five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The EQ-5D-5L questionnaire has an associated utility which is derived from its preference-based score in the Thai population.[20]

Statistical analysis

Sample size calculation

The effect of the CGA and MDT intervention on ADL outcomes from a previous study showed that older adults who received CGA and MDT intervention in an IPD setting and were followed up for 3 months had a higher mean Barthel ADL score than those in the usual care group (17.15 vs 14.35).[14] To achieve a power of 90% and a two-sided significance level of 0.05, 126 older adults were required to detect a difference. Considering a potential loss to follow up rate of 10%, the total sample size needed was 138 older adults.

Data analysis

A per-protocol analysis was used for the clinical outcomes. A linear model was performed to analyze the change in clinical effectiveness (mean ADL scores using the (Barthel and Lawton indexes over 12 months. In the regression analysis, potential risk factors for the clinical outcomes with a P value of <0.2 from the univariate analysis were included. The categorical data, including extra visits, hospitalization, fall rate, death rate, and patient satisfaction, were compared between the 0^{th} month and 12^{th} months to assess the effects of the CGA and MDT intervention versus usual care. For the proportional effectiveness analysis of categorical outcomes, a chi-square test was used. For continuous variables, a Student's t-test was applied to normally distributed data, while the Mann-Whitney U test was used for non-normally distributed data. The estimated effect size was reported as a mean or median difference for relevant data, along with 95% confidence intervals. Statistical analyses were conducted using PASW Statistics 18 (SPSS Inc., Chicago, IL, USA). All tests were two-tailed, and a p-value of less

than 0.05 was considered statistically significant. The outcome of the economic analysis was based on the intention-to-treat analysis.

To estimate the costs and QALY, and assess the cost-effectiveness of the CGA and MDT service, a decision tree was applied to model the transitional states of older adults' ADL from the 0th to the 12th month, dividing participants into the intervention arm (CGA and MDT) and the control arm (usual care). Following this, a simple two-state Markov model ("Alive" and "Dead") was employed.[21,22] In the Markov model, all participants interviewed after the 1-year follow-up started in the "Alive" state. During each annual Markov cycle, they faced a risk dying and could transition to the absorbing "Dead" state[5] (Supplementary Fig 2). The annual risk of dying was based on the all-cause 1-, 5-, and 10-year mortality rates in older adults, as described in the study of activities of daily living stages by Stineman MG.[17] The model ran for 30 cycles to ensure that, by the end of the analysis, all participants had transitioned to the "Dead" state. For each Markov cycle in which participants remained in the "Alive" state, they incurred an annual cost and QALY estimate. No costs or QALY were associated with the "Dead" state. At the end of the analysis, the discounted costs and QALY were summed over all cycles to estimate the per-participant mean costs and QALY for both CGA and usual care, respectively. The model was implemented in Microsoft Excel, with the outcome presented as total cost and total QALY.

The ICER was used to measure cost-effectiveness by dividing the difference in costs between the intervention and control groups by the difference in QALY gained. This helped determine if the CGA and MDT services provided more benefit per cost compared to usual care.

A probabilistic sensitivity analysis was conducted to account for uncertainty. Cost-effectiveness acceptability curves and cost-effectiveness plane were used to explore uncertainties in costs and outcomes. A Monte Carlo stimulation[23] was employed, generating 1,000 rounds of simulation using a gamma distribution for cost uncertainties and a beta distribution for utility and probability of death in each ADL state parameter. The costs of CGA and MDT and usual care, as well as QALY data, were collected over one year from the hospital database and patient interviews.

RESULTS

Patient characteristics

At baseline, each group consisted of 69 older adults. The older adults in CGA and MDT and usual care groups were comparable in many aspects. For example, the mean age was 81.5 (± 8.6) years in the CGA and MDT group and 77.6 (± 8.3) years in usual care group, respectively (Table 1). However, the CGA and MDT group had lower TMSE scores compared to the usual care group. There was also a higher proportion of older adults with dementia, OA knee and recent hip fracture within 3 months in the CGA and MDT group. Cancer patients were present in both groups (Table 1).

Outcomes

Clinical effectiveness analysis

After one year of follow-up, the clinical outcomes were summarized in supplementary table 1. Older adults in the CGA and MDT group showed greater improvement in nutritional status compared to those in the usual care group. Specifically, the MNA-SF score for older adults who received CGA and MDT services from a Geriatric OPD improved significantly, increasing from 9.3 (± 3.3) to 10.9 (± 2.9), p=0.01 (Table 2). In contrast, the usual care group showed a non-significant change in their MNA-SF score over the same period (10.1 (± 2.8) vs 10.2 (± 2.6), p=0.69) (Table 2). Other clinical outcomes were similar between the two groups.

The CGA and MDT services in the OPD setting did not demonstrate a reduction in unplanned OPD visits, hospitalizations, ER visits, or occurrences of serious and non-serious falls. Additionally, there was no significant decrease in mortality rates after one year of r follow-up, with 12 deaths in the CGA and MDT group and 13 in the usual care group (21.8% vs 25.0% p=0.76) (Supplementary Table 2).

Quality-adjusted life year

At the one-year follow-up, the number of older adults in the CGA and MDT group was 55, while the usual care group had 52 participants. At baseline, the CGA and MDT group had a non-significant utility difference compared to the usual care group (0.68 (± 0.23) vs 0.60 (± 0.24)) (Supplementary Table 2). After one year, the CGA and MDT group showed an increase in utility, rising from 0.68 (± 0.23) at baseline to 0.76 (± 0.21) (p=0.01) (Table 3). Similarly, the usual care also experienced an increase in utility from 0.60 (± 0.24) at baseline to 0.72 (± 0.22) after one-year (p=0.01) as shown in Table 2. Both groups demonstrated significant improvement in utility.

Economic evaluation: cost-effectiveness analysis

The relevant costs for CGA and MDT and usual care were US$8,309 and $9,039, respectively. The QALYs for the CGA and MDT and usual care groups were

TABLE 1. Baseline characteristics and underlying diseases.

Categories	CGA & MDT N = 69	Usual care N = 69	p-value
Age (SD)	81.5 ± 8.6	77.6 ± 8.3	0.08
Female (%)	49 (71%)	45 (65%)	0.573
No income (%)	73%	65.7%	0.796
Barthel score (Max 20) (SD)	15.0 ± 4.8	15.4 ± 4.2	0.6
Lawton score (Max 8) (SD)	3.4 ± 2.3	3.8 ± 2.4	0.155
Charlson comorbidity index (SD)	5.2 ± 1.5	5.4 ± 1.9	0.469
TMSE score (SD)	19.9 ± 7.7	23.8 ± 8.3	0.004
Utility (EQ5D5L) (SD)	0.68 ± 0.23	0.60 ± 0.24	0.060
MNA SF score (SD)	9.1 ± 2.6	9.9 ± 2.7	0.066
Previous fall times within 3 months			
1 time	15	9	0.310
2 times	18	16	
Underlying disease			
HT	42 (61)	47 (68)	0.374
DM	15 (22)	27 (39)	0.26
DLP	25 (36)	29 (42)	0.49
Stroke (Ischemic and Hemorrhagic)	12 (17)	12 (17)	1
- recent stroke within 6 months	0 (0)	1 (1.4)	
Recent hip fracture			
- within 3 months	13 (19)	0 (0)	<0.001
Dementia	13 (19)	1 (1.4)	0.001
Coronary Artery Disease	3 (4)	8 (11.5)	0.116
Spondylopathy	4 (6)	3 (4)	0.698
Parkinson disease	3 (4)	4 (5.8)	0.698
CKD any stage	12 (17.4)	17 (25)	0.317
NPH	2 (3)	1 (1.4)	0.559
Liver cirrhosis	1 (1.4)	4 (6)	0.172
CA stage I to III	8 (12)	7 (10)	
ongoing radiotherapy	0 (0)	1 (1.4)	
ongoing chemotherapy	0 (0)	1 (1.4)	0.97
CA stage IV (metastasis)	0 (0)	2 (3)	
ongoing oral chemotherapy	0 (0)	1 (1.4)	0.154
OA knee	17 (25)	3 (4)	0.001
COPD	2 (1.4)	1 (1.4)	0.559

Abbreviations: CGA = comprehensive geriatric assessment, MDT = multidisciplinary team, TMSE = Thai mental state examination, MNA SF = mini-nutritional assessment short form, EQ5D5L = European quality of life five dimensions five levels, UC = universal coverage, SD = standard of deviation, HT = hypertension, DM = diabetic mellitus, DLP = dyslipidemia, CKD = chronic kidney disease, NPH = normal pressure hydrocephalus, CA = cancer, OA = osteoarthritis, COPD = chronic obstructive pulmonary disease

TABLE 2. Comparison of baseline and 1-year outcomes of the CGA and MDT group and usual care group.

Categories	baseline	12-month	p value
CGA & MDT group	**N = 55**	**N = 55**	
Barthel score (Max 20) (SD)	16 ± 5.1	15.52 ± 4.3	0.09
Lawton score (Max 8) (SD)	3.6 ± 2.3	3.9 ± 2.5	0.15
TMSE score (SD)	20.8 ± 7.4	20.9 ± 7.3	0.99
Utility (EQ5D5L) (SD)	0.66 ± 0.24	0.76 ± 0.21	0.01
MNA-SF score (SD)	9.3 ± 3.3	10.6 ± 2.9	0.01
Usual care	**N = 52**	**N = 52**	
Barthel score (Max 20) (SD)	15.5 ± 4.4	15.8 ± 4.1	0.45
Lawton score (Max 8) (SD)	3.94 ± 2.5	4.29 ± 2.4	0.13
TMSE score (SD)	23.54 ± 5.1	22.8 ± 4.8	0.07
Utility (EQ5D5L) (SD)	0.62 ± 0.25	0.72 ± 0.22	0.01
MNA-SF score (SD)	10.1 ± 2.8	10.2 ± 2.6	0.69

Abbreviations: TMSE = Thai mental state examination, MNA= mini-nutritional assessment, EQ5D5L= Euro quality of life group 5 dimensions 5 levels, MNA-SF= mini-nutritional assessment short form, SD= standard deviation

TABLE 3. Costs, health outcomes, and ICER of the CGA and MDT group compared to the usual care group.

options	Total cost (US dollar)	Life-years (years)	QALY (years)	ICER (US dollar/QALY)
Usual care	9039	2.3216	2.0840	
CGA&MDT	8309	2.9477	2.7688	
Incremental value	-730	0.1789	0.2376	-3073 (dominant)

Abbreviations: CGA&MDT= comprehensive geriatric assessment and Multidisciplinary team, Lys = life years, QALY = quality adjusted life year (currency rate in January 2022: 35.05 Baht = 1 US dollar)

2.321 and 2.084, respectively. The incremental cost was $-730, and the incremental QALYs were 0.237. The incremental life year gain at one year was 0.18 years. Based on probabilistic analysis, the incremental cost-effectiveness was cost-saving at $3,073 per QALY (Table 3).

Uncertainty analysis

The cost-effectiveness acceptability curve, based on the net benefit approach, was used to illustrate the relationship between the ceiling ratio (willingness to pay for a unit of QALY gained) and the probability of favoring each group. From a societal perspective, the results indicated that the CGA and MDT service, at a cost of $4,564 per QALY gained, had a 90% probability of being cost-effective, while the usual care service had only a 10% probability (Fig 2). Therefore, the CGA and MDT service was the preferred choice.

The results of the probabilistic analysis are shown on the cost-effectiveness plane (Supplementary Fig 3). The joint distribution of incremental costs and QALYs reveals that the CGA and MDT service is associated with a slightly decrease in cost in 99% of the simulations (at a cost-effectiveness threshold of $4,564) and a gain in QALYs in 92 % of the simulations.

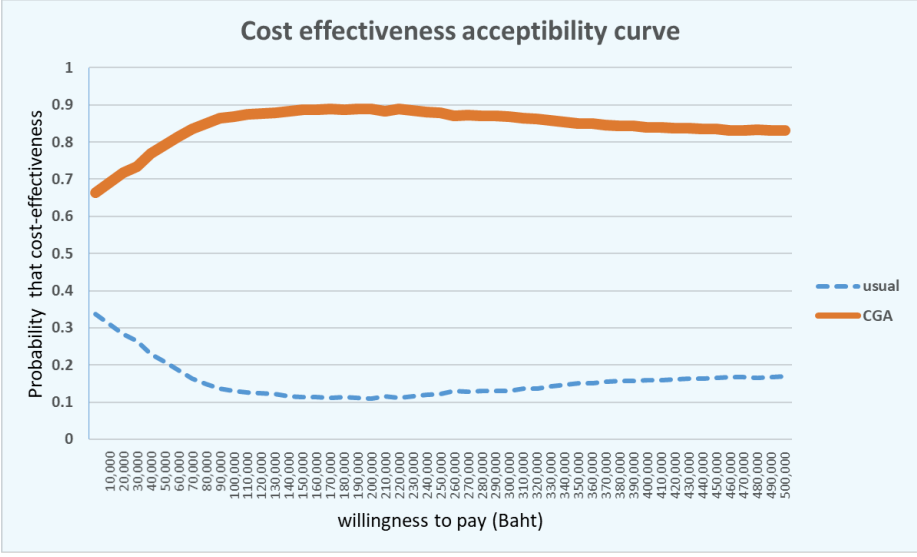

Fig 2. Cost-effectiveness acceptability curves for quality-adjusted life-year gained
Abbreviation: CGA= comprehensive geriatric assessment and multidisciplinary team

DISCUSSION

This was the first prospective study to assess the clinical effectiveness and cost-effectiveness of a geriatric service at a Geriatric OPD in a tertiary hospital within a medical school in Thailand. Previous studies on the cost-effectiveness and clinical effectiveness of OPD services were conducted in municipal ambulatory OPD settings in Sweden[5] and community clinics in England.[25] While these European studies demonstrated clinical effectiveness benefits, the cost analysis did not show cost-effectiveness due to the high intervention costs. In contrast, this study found that CGA and MDT was a cost-saving intervention in the OPD setting in Thailand.

Following these initial findings on cost-effectiveness, a closer look at baseline characteristics reveals further insights into the unique benefits observed in the CGA and MDT group. The baseline characteristics between two groups were similar, although the CGA and MDT group had a lower TMSE score compared to the usual care group at baseline. Despite this, the outcomes showed that MNA-SF score in the CGA and MDT improved more than in the usual care group, while both groups experienced an increase in quality of life along over the one-year study period. The improvement in nutritional status among older adults could be attributed to the CGA and MDT service, which maintained the physical, mental and functional health of patients with poor nutritional status. This was achieved by providing appropriate nutritional education and nutritional supplements to effectively enhance their nutritional health.

In addition to nutritional improvements, the study also considered the broader context of quality of life, especially considering pandemic-related challenges. The evaluation of quality of life (EQ-5D-5L score) appeared to be lower than the mean score for the Thai population.[20] Several factors may explain this finding. First, this study was conducted during the COVID-19 pandemic, which directly affected older adults' quality of life, particularly in terms of depressed mood and anxiety, as well as the well-being of caregivers.[26-28] Secondly, most older adults in this study were female, had multiple comorbidities, and experienced financial problems due to the lockdown, all of which are associated with lower quality of life scores.[29]

While these factors impacted quality of life, the study also assessed how CGA and MDT services affected healthcare utilization and mortality, providing a comprehensive view of their impact on older adults. The CGA and MDT services in the OPD setting did not demonstrate a benefit in reducing unplanned OPD visits, hospitalizations, ER visits, or the incidence of serious and non-serious falls. Additionally, the CGA and MDT services did not decrease the number of deaths during the one-year follow-up period. This may be because the CGA and MDT service did not directly address the primary causes of mortality in older adults, particularly those due to infectious diseases. Neither the death rate nor the occurrence of undesirable events (unplanned OPD visits, hospitalizations, ER visits, serious and non-serious falls) was found to be directly preventable through this intervention.

Although certain healthcare utilizations were not significantly reduced, comparing these findings with studies from different regions emphasizes the cost-effectiveness of CGA and MDT services in specific contexts. The

findings indicated that while CGA and MDT services were a more expensive option in terms of direct medical costs, they were likely to provide better outcomes in nutritional status and quality of life compared to usual care. Although the cost of medical personnel in the CGA and MDT group was three times higher than that of the usual care group, other societal costs associated with CGA and MDT were lower. This demonstrates both clinical and cost effectiveness, similar to the study by *Soejono CH*[14] in Southeast Asia. However, that study was non-randomized control trial and was conducted in an IPD setting. It showed that the CGA provided clinical and cost benefits over usual care in the 30 days follow-up after hospitalization. In our study, the cost savings in the CGA and MDT group were mainly due to a trend of fewer extra OPD visits and unplanned admissions. While these numbers were not statistically lower than those in in the usual care group, the total cost savings still suggested cost-effectiveness. Interestingly, the CGA and MDT service did not significantly reduce unexpected events but did contribute to overall cost-saving results. The number of extra OPD visits in the GCA and MDT group was not lower than in the usual care group, a finding that contrasts with the study by *Wei et al*.[30] The study by *Wei et al* reported reduced number of drugs prescribed, fewer healthcare utilization in terms of OPD visits, emergency department visit, and hospitalizations among older adults in the Geriatric OPD which provided the CGA and MDT services as compared to non-geriatric OPD clinic. The reduction in medical costs was shown in patients with more comorbidities and an older age (≥ 80 years).

Our study cannot be directly compared with others conducted in different countries due to variations in the cost of living.[31] In Europe and the US, the cost of living is 3-4 times higher than ASEAN countries, which corresponds to the higher costs of medical care, including medical personnel, as shown in many studies.[10,32] The CGA and MDT service improved the quality of care for older adults by detecting undiagnosed problems, such as cognitive impairment, depression, fall risk, inappropriate medication use and urinary incontinence.[33] This highlights the potential benefit of CGA and MDT services in low to middle-income countries, where lower medical care costs can significantly enhance the quality of clinical practice for older adults.

A probabilistic sensitivity analysis was conducted to assess uncertainty, confirming that the CGA and MDT service was more cost-effective than usual care in terms of QALY gained. The acceptability curves indicated that the cost per QALY, from a societal perspective was approximately $3,052 per QALY, which is lower than the national threshold of $4,564 per QALY.[24] Therefore, the CGA and MDT service not only results in societal cost savings but also improves the quality of life for older adults.

The study's strengths in design contribute to the reliability of these findings, despite certain limitations. The study lies in its prospective design with a follow-up period of up to one year, demonstrating significant clinical and cost outcomes in the Geriatric OPD. Other studies on cost-effectiveness analysis have been retrospective, which can introduce limitations such as recall bias and difficulties in accurately collecting cost data.[34] Moreover, previous studies did not find that CGA and MDT services in an OPD setting were cost-saving; they primarily demonstrated clinical effectiveness in providing more palliative care services.[5,35]

Nevertheless, acknowledging study limitations helps in understanding the scope and generalizability of these results, especially considering pandemic-era data and the unique baseline differences observed between groups. First, the COVID-19 pandemic during the study period affected the number of older adults receiving the MDT service. This could affect the service provision from the non-COVID period. Second, we did not identify the specific causes leading to extra admissions, ER visit and falls. Some causes might not be avoidable even with the CGA and MDT. Third, there were slight difference in baseline characteristics between the 2 groups which might affect the outcomes. The potential confounding variables such as age, income, ADL, illness severity (determined by Charlson Comorbidity Index: CCI) were not significantly different between group. However, some of the illness conditions were different such as dementia, OA knee and recent hip fracture within 3 months. Dementia and OA knee were more prevalent in the CGA & MDT group, while recent hip fracture was more prevalent in the usual care group. These could affect the service need and clinical outcomes. Lastly, as the study was conducted in a single medical school, which is a tertiary hospital in Bangkok Metropolitan with a large number of older adults and MDT experts, generalizing the results nationwide requires caution due to the lack of such expertise in other healthcare settings and different living expenses.

CONCLUSION

This study demonstrates the clinical and economic effectiveness of CGA and MDT services in an outpatient setting, affirming their role as essential components of elderly care for enhancing quality of life and managing

health-related costs. The broader implications of these findings suggest that CGA and MDT services could be beneficial beyond Thailand, serving as a model for aging populations worldwide. By focusing on cost-effectiveness and holistic care, these interventions can help healthcare systems meet the complex needs of older adults, providing sustainable and high-quality care on a global scale. Further research in diverse healthcare settings is needed to refine this model, ensuring that CGA and MDT remain adaptable to the unique challenges of different regions and healthcare infrastructures.

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DECLARATION

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Author Contributions

Conceptualization and methodology, P.V., S.I., N.T., S.M. and W.M. ; Investigation, P.V.; Formal analysis, P.V., N.T., S.M. and W.M. ;Visualization and writing – original draft, P.V., N.T. and S.M.; Writing – review and editing, W.M., N.T. and S.M; Supervision, W.M. All authors have read and agreed to the final version of the manuscript.

Use of artificial intelligence

The manuscript is not produced using artificial intelligence.

Human ethics approval declaration

This study was approved by the Institutional Review Board, Bangkok, Thailand (IRB No. 1057/2563). Written informed consent was obtained from each older adult or their legal representative.

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