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Original Article

Traditional Chinese Medicine as a Protective Factor Against Acute Healthcare Events in Geriatric Multi-joint Osteoarthritis: A Real-World Evidence

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Objective: To investigate the impact of integrative traditional Chinese and Western medicine (CWM) on the risks of emergency department (ED) visits and hospitalizations in older patients with multi-joint osteoarthritis (MJOA), and to evaluate the clinical benefits of Chinese herbal medicines. **Methods:** This retrospective cohort study included MJOA patients aged ≥65 years (mean age: 73.6 years) diagnosed between 2016 and 2022. Patients were categorized into a Western medicine group (WM; n=7,848) and an integrative CWM group (n=2,306). A 28-day landmark analysis was used to mitigate immortal time bias (ITB), and propensity score matching (PSM) was applied to balance baseline characteristics. Univariate Cox proportional hazards models were used to estimate hazard ratios (HRs). Furthermore, a subgroup analysis was conducted for users of the formula Gui-Lu-Er-Xian-Jiao (GEJ). **Results:** After ITB adjustment, the CWM group showed a significantly lower risk of hospitalization compared to the WM group (HR=0.873; 95% CI: 0.812 to 0.939; p<0.001), while the risk of ED visits showed

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no significant difference. The GEJ subgroup also demonstrated a significantly reduced hospitalization risk (HR=0.861; 95% CI: 0.794 to 0.933; p<0.001); however, the trend toward a reduced ED risk did not reach statistical significance (p=0.088). Additionally, timing analyses revealed that immediate (day 0) or early (≤3 months) intervention significantly reduced the hospitalization risk, whereas delayed intervention (>3 months) yielded no protective benefits. **Conclusion:** Integrative CWM was associated with a lower risk of hospitalization in older MJOA patients. As a core formula, GEJ exerts protective effects, likely by helping mitigate the dual burden of joint degeneration and osteosarcopenia. These findings support traditional Chinese medicine as a valuable adjunctive therapy for MJOA and highlight the critical importance of early intervention in mitigating the acute healthcare burden in aging populations.

Key words: multi-joint osteoarthritis, older adults, traditional Chinese medicine, Gui-Lu-Er-Xian-Jiao, hospitalization rate

Introduction

Osteoarthritis (OA) is a degenerative joint disease commonly affecting the shoulders, hips, and knees. The primary symptom is joint pain, which worsens with movement and leads to functional impairment [1-3]. However, in older adults, OA frequently presents as a multiple joint phenotype, known as multi-joint osteoarthritis (MJOA), multisite osteoarthritis or polyosteoarthritis. Recent evidence indicates that MJOA is not merely a localized biomechanical wear-and-tear condition [4, 5]; rather, it is deeply intertwined with systemic low-grade inflammation, metabolic abnormalities [6], and osteosarcopenia (a syndrome characterized by the concurrent presence of osteoporosis and sarcopenia) [7].

Driven by shared mechanisms of pro-inflammatory cytokines in patients with MJOA, this systemic inflammatory process significantly accelerates muscle and cartilage degradation [7], increasing the risk of multimorbidity, severe disability, and even higher all-cause mortality [4, 8]. Consequently, these highly vulnerable older patients face a substantially elevated risk of acute healthcare utilization, driving a surge in emergency department (ED) visits and hospitalizations [8]. As Taiwan transitions into a super-aged society, with 19.2% of its population aged 65 years or older in 2024, addressing the profound impact of MJOA on acute healthcare utilization and quality of life is increasingly critical.

Current conventional treatment strategies for OA primarily focus on symptom management using nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, and eventually, joint replacement surgery [9-11]. However, for elderly patients with MJOA, these approaches present significant clinical challenges. Multimorbidities, such as chronic liver or renal diseases, frequently limit or contraindicate the long-term use of NSAIDs [12]. Furthermore, frailty and advanced age often preclude surgical intervention, creating a critical therapeutic gap in both disease management and the reduction of acute healthcare utilization. Consequently, older patients must rely heavily on long-term nursing and

conservative management, ultimately leading to a substantial escalation in medical expenditures as age increases [8].

In this context, Traditional Chinese Medicine (TCM) offers a compelling alternative. TCM emphasizes a holistic approach (overall regulation of the body's internal organ balance and systemic metabolism), which is consistent with the current scientific paradigm shifting from localized structural treatments to systemic metabolic regulation for complex, multi-site joint diseases [4-6]. In Taiwan, TCM plays a significant role in the healthcare system, with millions of annual outpatient visits for symptom management [13, 14]. While recent studies have supported TCM's efficacy in relieving pain and improving joint function, there is a distinct lack of real-world evidence regarding whether TCM integration can actively reduce the risk of severe acute healthcare events, such as ED visits and hospitalizations, in highly vulnerable older patients with MJOA [7, 8].

To bridge this gap, this study aimed to investigate the potential association between TCM integration and the reduction of acute healthcare events in older patients with MJOA. By utilizing the Chang Gung Research Database (CGRD)—derived from Taiwan's largest medical network, which handles over 9.4 million outpatient visits and 30,000 admissions annually [15]—we sought to evaluate the efficacy of TCM as a secondary preventive strategy. Through robust analysis of TCM utilization patterns and specific herbal formulations, this research ultimately aims to guide integrative treatment strategies, addressing the limitations of conventional therapies and lowering acute healthcare burdens for the elderly.

Materials and methods

1. Study Design and Data Source

The study used data from the CGRD, a de-identified medical records database of the Chang Gung Memorial Hospital (CGMH) healthcare system in Taiwan. The CGRD contains comprehensive clinical and epidemiological information, including laboratory tests, inpatient and outpatient records, emergency visits, examinations, and disease classifications [16].

To protect privacy, all patient and provider information was encrypted and de-identified. The study followed the Declaration of Helsinki and Good Clinical Practice guidelines. Ethical approval was granted by the CGMH Institutional Review Board (Approval No. 202201917B0; January 16, 2023). As all data were de-identified before release, informed consent was waived in accordance with IRB regulations.

2. Study Population Selection

This retrospective cohort study analyzed electronic health records from the CGRD between January 1, 2016, and December 31, 2022. Regarding eligibility criteria, the study population consisted of patients diagnosed with MJOA, defined by the ICD-10 code M15 (polyosteoarthritis) in their medical records.

To ensure the inclusion of a high-risk population with severe conditions, patients had to fulfill at least one of the following criteria within one year prior to the index date: (1) two or more outpatient visits to specialized departments (neurology, orthopedics, rheumatology, or rehabilitation; excluding TCM clinics) ; (2) one or more M15-associated hospitalizations ; or (3) one or more M15-associated ED visits. An M15-associated encounter was defined as any medical encounter with the M15 code documented in any diagnosis position.

The index date was established as the date on which these criteria were first satisfied (e.g., the date of

the second outpatient visit or the discharge date from the first M15-associated hospitalization or ED visit). A M15-associated hospitalization or ED visit was defined as any healthcare encounter containing the ICD-10 code M15 in any diagnosis position. A total of 20,523 patients met these initial inclusion criteria.

For the exposure definition, patients were categorized into two groups. The Western Medicine (WM) Group received standard care only, while the Combined Western and TCM (CWM) Group included patients receiving TCM who met specific adherence criteria: they must have received concurrent Western medicine within 30 days of TCM initiation and completed a continuous 28-day course of TCM.

The start of follow-up began immediately after the index date. As this study focuses on secondary prevention, the outcome definition was strictly limited to new acute healthcare events occurring after the index date.

Specific exclusion criteria were applied to refine the final cohort. Patients were excluded if they were younger than 65 years at the index date. Furthermore, patients initially assigned to the CWM group were excluded if they failed to meet the aforementioned 30-day concurrent Western medicine window or the 28-day minimum TCM treatment requirement. After these exclusions, 7,848 patients remained in the WM Group and 2,306 in the CWM Group (Figure 1).

3. Covariates

To control for baseline confounding, covariates reflecting systemic disease burden and potential selection bias were extracted. These included: (1) demographics (age and sex); (2) ICD-10-identified comorbidities, including diabetes mellitus (E08–E13), hypertension (I10–I16), hyperlipidemia (E78), liver disease (K70–K77), and kidney disease (N18); and (3) baseline healthcare utilization (frequency of ED visits and hospitalizations within one-year period before the index date). Notably, liver and kidney diseases were included because they often limit conventional NSAID use, thereby influencing a patient's preference for TCM. Additionally, diabetes mellitus, hypertension, and hyperlipidemia were included because these conditions are key components of metabolic syndrome, which is known to exacerbate multi-joint osteoarthritis (MJOA) through systemic chronic inflammation [50]. Furthermore, rather than incorporating localized structural joint severity—which is difficult to standardize retrospectively for polyosteoarthritis (M15) and less predictive in this population—we utilized systemic comorbidities and baseline healthcare utilization as proxies for disease severity. Recent evidence indicates that systemic multimorbidity, rather than localized joint degradation, primarily drives acute healthcare utilization in older OA patients [4-6, 8]. Consequently, these covariates served as comprehensive indicators of physiological vulnerability and were utilized in the propensity score matching (PSM) model to ensure balanced group comparisons. Detailed statistical procedures are elaborated in Section 2.5 (Statistical Analysis and Propensity Score Matching)

4. Management of Immortal Time Bias and Treatment Timing

To strictly account for immortal time bias (ITB)—particularly the survivor bias inherent in the requirement that patients in the CWM group complete a continuous 28-day course of herbal medication—a 28-day landmark analysis was implemented. Consequently, the study's observation period for all outcomes commenced on the 29th day following the index date. To ensure the integrity of the comparison

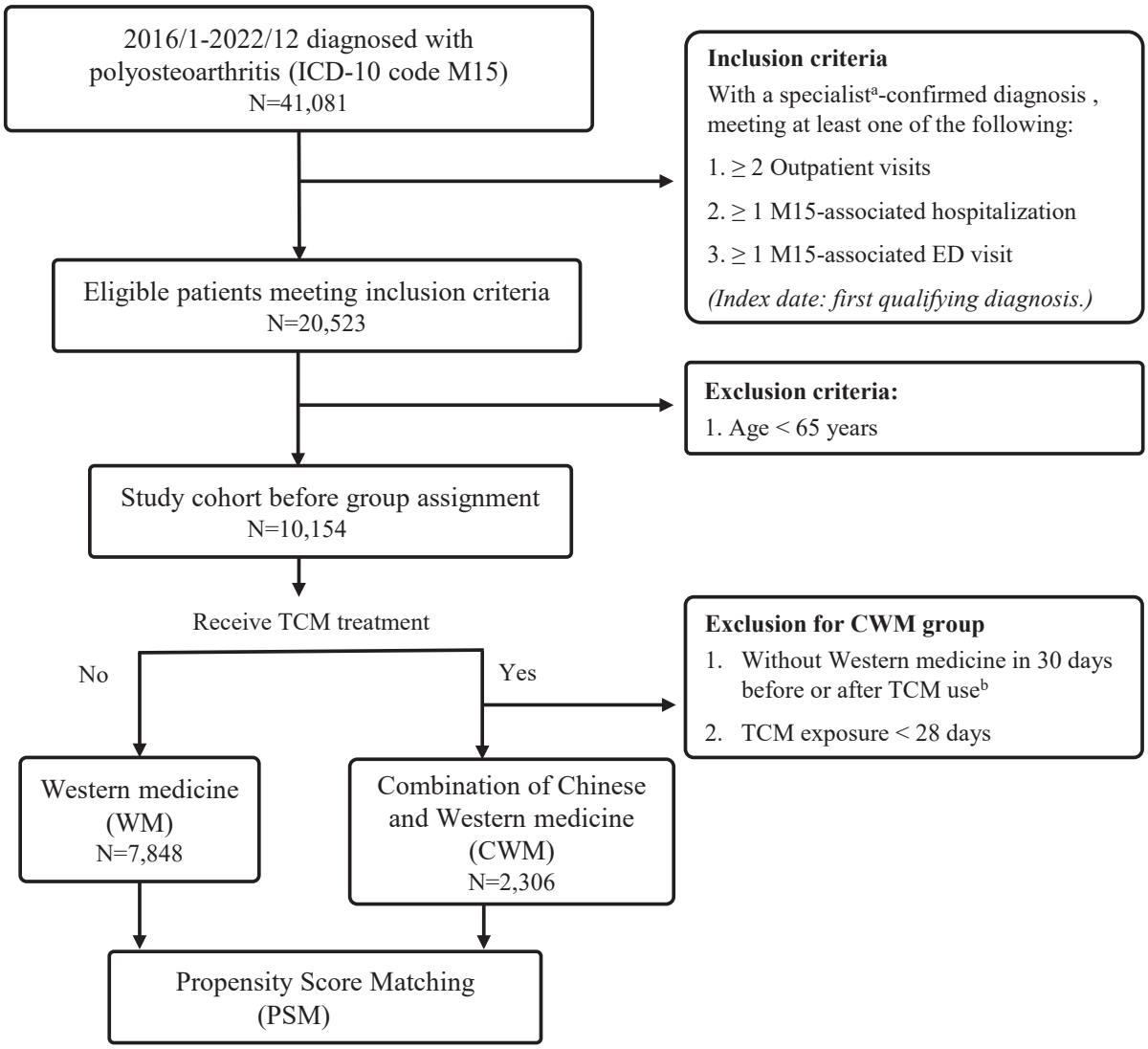


Figure 1. Flowchart of the study.

[a] Specialists include neurologists, orthopedic surgeons, rheumatologists, and rehabilitation physicians, excluding TCM clinics.

[b] Ensure that the included patients received combined Western and Chinese medicine treatment within a similar timeframe.

while maintaining the matched structure, patients in either group who experienced an acute healthcare event or were censored within this initial 28-day 'guarantee period' were symmetrically excluded after PSM [17].

To further eliminate ITB caused by the variable waiting time from the index date to actual TCM initiation, and to evaluate the impact of treatment timing, a sensitivity analysis categorized the CWM group into three subgroups: Immediate intervention (0 days, which strictly synchronizes the start of observation and exposure to ensure zero immortal time [18]), Early intervention (≤ 3 months, corresponding to the standard 3-month conservative care evaluation window) [23,51], and Delayed intervention (> 3

months). This 3-month cutoff was selected because delaying intervention beyond this window reflects a failure of timely relief from conventional therapies, which can lead to prolonged pain and chronic immobility that gradually trigger systemic frailty.

5. Statistical Analysis and Propensity Score Matching

Baseline characteristics were summarized using descriptive statistics; continuous variables were presented as mean ± standard deviation (SD), and categorical variables as counts and percentages. To minimize selection bias, especially regarding age and disease severity, Propensity Score Matching (PSM) was employed. Propensity scores were estimated via a logistic regression model incorporating all aforementioned covariates. We performed 1:4 or 1:3 nearest-neighbor matching without replacement, with a caliper width set at 0.2 times the SD of the logit of the propensity score. A Standardized Mean Difference (SMD) < 0.1 was considered indicative of a well-balanced distribution between groups. Following the 28-day landmark exclusion post-PSM, the SMDs of all covariates were re-assessed to ensure that the balance between the WM and CWM groups remained robust (all SMDs < 0.1).

For outcome analysis, the risks of hospitalization and ED visits were evaluated as time-to-event outcomes. Kaplan-Meier curves with log-rank tests were used to compare the cumulative hospitalization-free and emergency-free probabilities between groups. Furthermore, univariate (crude) Cox proportional hazards regression models based on the matched cohort were conducted to estimate hazard ratios (HRs) and 95% confidence intervals (CIs). Because the PSM successfully balanced all covariates between the groups, no further adjustments for these confounders were performed in the Cox models. All analyses were performed using SPSS (Version 22.0, IBM, NY), with statistical significance set at $p<0.05$.

Results

1. Baseline Characteristics

A total of 10,154 patients aged ≥65 years were included. In the WM group (n=7,848), the mean age was 74.98 years (SD = 7.11) and 68.1% were female. In the CWM group (n=2,306), the mean age was 73.66 years (SD = 6.25) and 66.6% were female. Before matching, comorbidity profiles (DM, HTN, hyperlipidemia, liver and kidney disease), and baseline healthcare utilization (ER visits and hospitalizations) were comparable between the groups. However, age showed an imbalance (SMD = 0.197), requiring adjustment.

After PSM, 6,894 WM patients and 2,298 CWM patients remained. Baseline differences were substantially reduced, with all predefined covariates achieving an SMD < 0.1, including sex (SMD = 0.038) and age (SMD < 0.001), indicating good balance. The matched mean age of both groups was 73.67 years (SD = 6.29 for WM; 6.25 for CWM). These results confirm adequate comparability between groups after matching, particularly regarding age (Table 1).

2. Usage patterns of TCM formulas and CHPs for multi-joint osteoarthritis treatment

Gui-Lu-Er-Xian-Jiao (GEJ) was the most frequently prescribed TCM formula, with 20,893 visits during follow-up, accounting for 14.8% of all herbal formula prescriptions. Its use was three times higher than the second most common formula, Shu-Jing-Huo-Xue-Tang (4.9%), underscoring its clinical

Table 1. Comparison of the TCM and Western Medicine combination therapy group and Western Medicine group of patients aged ≥ 65 years

	Before PSM N=10,154			After PSM[a] N=9,192		
	WM N=7,848	CWM N=2,306	SMD	WM N=6,894	CWM N=2,298	SMD
Sex: Men (%)	2,507 (31.9)	771 (33.4)	0.032	2,184 (31.7)	769 (33.5)	0.038
Age (SD)	74.98 (7.11)	73.66 (6.25)	0.197	73.67 (6.29)	73.67 (6.25)	<0.001
Chronic conditions (SD)[b]						
DM	1,914. (24.4)	510 (22.1)	0.054	1,666(24.2)	509 (22.1)	0.048
HTN	3,771 (48.1)	1,033 (44.8)	0.065	3,234 (46.9)	1,031 (44.9)	0.041
Hyperlipidemia	2,494 (31.8)	807 (35.0)	0.068	2,195 (31.8)	803 (34.9)	0.066
Liver Disease	1,116 (14.2)	399 (17.3)	0.085	1,012 (14.7)	398 (17.3)	0.072
Kidney Disease	896 (11.4)	233 (10.1)	0.042	749 (10.9)	233 (10.1)	0.024
ER visiting (SD)	2.04 (4.37)	2.20 (4.75)	0.034	1.91 (4.20)	2.20 (4.75)	0.064
Hospitalization (SD)	1.21 (2.24)	1.14 (2.08)	0.034	1.17 (2.18)	1.13 (2.08)	0.015

[a] PSM was used to reduce confounding of age differences between the two groups, achieving well-balanced baseline characteristics with all post-matching SMDs below 0.1. Matching ratios were 1:3 for CWM vs. WM to optimize statistical efficiency.

[b] ICD-10 codes for the diseases: HTN (I10-I16), DM (E08-E13), Liver disease (K70-K77), Kidney disease (N18), and Hyperlipidemia (E78).

relevance in MJOA management. GEJ is traditionally used to strengthen tendons and bones and may relieve musculoskeletal pain and mobility impairment [19, 20]. More importantly, these bone-strengthening properties may help mitigate osteosarcopenia and frailty [21]—the core systemic vulnerabilities that drive acute healthcare events in older patients with MJOA. (Table 2).

Other frequently prescribed formulas included Shu-Jing-Huo-Xue-Tang, Dang-Gui-Nian-Tong-Tang, Ji-Sheng-Shen-Ci-Wan, and Du-Huo-Ji-Sheng-Tang. Additionally, commonly used single herbs included Du-Zhong (Eucommiae Cortex), Dan-Shen (Salviae Miltiorrhizae Radix Et Rhizoma), and Zhe-Bei-Mu (Fritillariae Thunbergii Bulbus). These herbs are known for their liver and kidney-tonifying or blood-activating and stasis-removing properties in TCM theory. Rather than merely targeting localized joint degradation, these properties reflect a holistic approach—regulating internal organ balance and systemic metabolism—

Table 2. Top 10 TCM formulas and single Chinese herbal products (CHPs) by number of prescriptions for MJOA patients aged 65 and over

Formula	N (%)	Single CHPs	N (%)
Gui-Lu-Er-Xian-Jiao	20,893 (14.8)	Du-Zhong *(Eucommiae Cortex)*	3,280 (2.8)
Shu-Jing-Huo-Xue-Tang	6,883 (4.9)	Dan-Shen *(Salviae Miltiorrhizae Radix Et Rhizoma)*	3,014 (2.6)
Dang-Gui-Nian-Tong-Tang	4,693 (3.3)	Zhe-Bei-Mu *(Fritillariae Thunbergii Bulbus)*	2,748 (2.4)
Ji-Sheng-Shen-Ci-Wan	4,297 (3.0)	Hai-Piao-Xiao *(Sepiae Endoconcha)*	2,479 (2.1)
Xiang-Sha-Liu-Jun-Zi-Tang	4,196 (2.9)	Niu-Xi *(Achyranthis Bidentatae Radix)*	2,413 (2.1)
Jia-Wei-Xiao-Yao-San	4,151 (2.9)	Mu-Li *(Crassostreae Concha)*	2,299 (2.0)
Du-Huo-Ji-Sheng-Tang	3,953 (2.8)	San-Qi *(Notoginseng Radix Et Rhizoma)*	2,042 (1.8)
Ma-Zi-Ren-Wan	3,740 (2.6)	Chuan-Niu-Xi *(Cyathulae Radix)*	1,880 (1.6)
Suan-Zao-Ren-Tang	3,652 (2.6)	Huang-Qi *(Astragali Radix)*	1,792 (1.5)
Ban-Xia-Xie-Xin-Tang	3,625 (2.6)	Da-Huang *(Rhei Radix Et Rhizoma)*	1,765 (1.5)

N: frequency of medication usage recorded between January 2016 and December 2022.

making them particularly suitable for addressing the systemic low-grade inflammation and metabolic abnormalities characteristic of MJOA. They may play a key role in mitigating the pathological changes and clinical symptoms of this complex, multi-site joint disease.

3. Kaplan-Meier and Cox Proportional Hazards Analysis of ED Visits and Hospitalization Rates

To mitigate immortal time bias, a 28-day landmark analysis was applied, symmetrically excluding patients with events or censoring within this period. Covariate balance was maintained after this adjustment, with all SMDs remaining below 0.1. K-M survival curves were used to evaluate the effect of CWM on the probability of remaining free from ED visits and hospitalizations. The K-M curves revealed no significant difference in emergency-free probability between the CWM and WM groups (log-rank p =0.953) (Figure 2A). Consistent with this finding, the univariate (crude) Cox proportional hazards model based on the matched cohort showed no significant risk reduction for ED visits in the CWM group compared to the WM group (HR=0.998, 95% CI: 0.931 to 1.069; p =0.953).

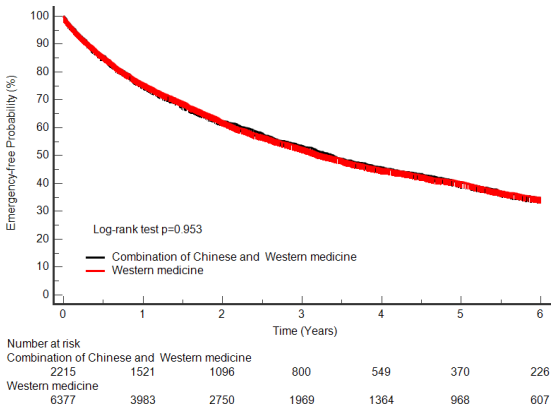
In contrast, the CWM group exhibited a significantly higher hospitalization-free probability (p <0.001) (Figure 2B). Because baseline covariates were already balanced via PSM, the crude Cox regression directly confirmed a significant overall 12.7% reduction in hospitalization risk for patients receiving

combined treatment (HR=0.873; 95% CI: 0.812 to 0.939; p <0.001).

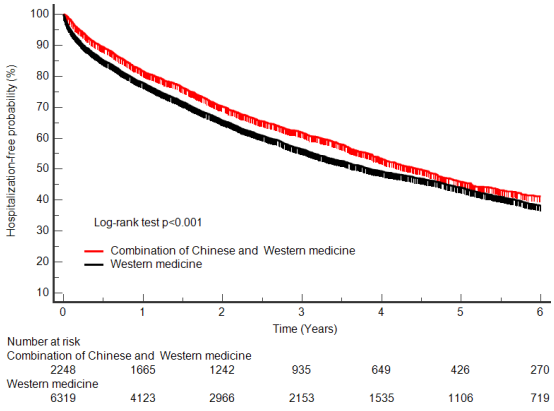
To further explore this benefit and eliminate potential immortal time bias caused by variable waiting times, a sensitivity analysis based on intervention timing was performed. The results indicated that both immediate (0 days) and early (≤3 months) TCM initiation significantly improved hospitalization-free outcomes compared to the WM group (HR: 0.806, 95% CI: 0.728–0.894, p < 0.001; and HR: 0.841, 95% CI: 0.725–0.974, p = 0.021, respectively). However, delayed intervention (>3 months) did not provide a statistically significant protective effect (HR: 0.980, 95% CI: 0.880–1.091, p = 0.711) (Figure 2C). These findings highlight the clinical importance of early CWM integration in potentially reducing the risk of acute healthcare events among older patients with MJOA.

4. Baseline Characteristics and Propensity Score Matching of the GEJ Cohort

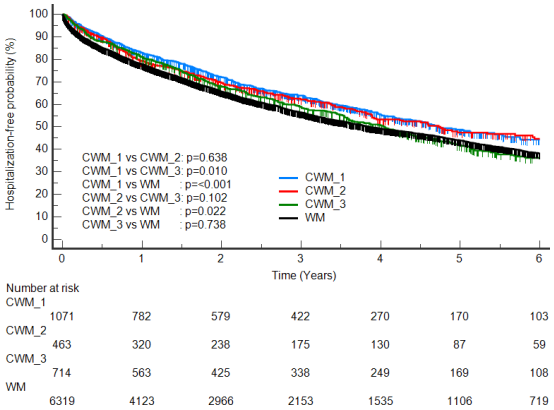
Medication frequency analysis showed that GEJ was the most commonly used formula in the CWM group. In routine clinical practice in Taiwan, patients aged ≥65 years with clinically and radiologically confirmed MJOA typically receive for GEJ (2.5–3 g twice daily) with follow-ups every 2–4 weeks to assess response, adherence, and adverse effects. Therefore, further analyses focused on patients who received GEJ treatment.



(A) Kaplan-Meier curves for ED-free probabilities.



(B) Kaplan-Meier curves for hospitalization-free probabilities.



(C) Kaplan-Meier curves for hospitalization-free probabilities stratified by TCM intervention timing.(CWM_1: Immediate Intervention, 0 days from MJOA diagnosis to TCM initiation; CWM_2: Early Intervention, ≤3 months; CWM_3: Delayed Intervention, >3 months)

Figure 2. Cumulative ED visit-free and hospitalization-free probabilities in elderly patients with MJOA: A comparison between CWM and WM cohorts

Table 3. Comparison of patients older than 65 years in the Gui-Lu-Er-Xiao-Jiao and Western medicine combination therapy group and Western medicine group

	Before PSM N=9,590			After PSM[a] N=8,695		
	WM N=7,848	CWM N=1,742	SMD	WM N=6,956	CWM N=1,739	SMD
Sex: Men	2,507 (31.9)	593 (34.0)	0.045	2,206 (31.7)	592 (34.0)	0.050
Age (SD)	74.98 (7.11)	73.74 (6.21)	0.186	73.72 (6.30)	73.74 (6.21)	0.003
Chronic conditions (SD)[b]						
DM	1,914 (24.4)	399 (22.9)	0.035	1,689 (24.3)	398 (22.9)	0.033
HTN	3,771 (48.1)	770 (44.2)	0.077	3,244 (46.6)	769 (44.2)	0.049
Hyperlipidemia	2,494 (31.8)	598 (34.3)	0.054	2,219 (31.9)	597 (34.3)	0.052
Liver Disease	1,116 (14.2)	290 (16.6)	0.067	1,018 (14.6)	289 (16.6)	0.055
Kidney Disease	896 (11.4)	176 (10.1)	0.042	751 (10.8)	176 (10.1)	0.022
ER visiting (SD)	2.04 (4.37)	2.04 (4.59)	<0.001	1.91 (4.20)	2.04 (4.60)	0.030
Hospitalization (SD)	1.21 (2.24)	1.06 (1.93)	0.070	1.16 (2.20)	1.06 (1.93)	0.046

[a] PSM was used to reduce confounding of age differences between the two groups, achieving well-balanced baseline characteristics with all post-matching SMDs below 0.1. Matching ratios were 1:4 for GEJ vs. WM to optimize statistical efficiency.

[b] ICD-10 codes for the diseases are as follows: HTN (I10-I16), DM (E08-E13), Liver disease (K70-K77), kidney disease (N18), and Hyperlipidemia (E78).

Table 3 presents the comparison of baseline characteristics between the GEJ+WM and WM groups. Before matching, the WM group (n=7,848) had a mean age of 74.98 years (68.1% female), while the GEJ+WM group (n=1,742) had a mean age of 73.74 years (66.0% female). Both groups exhibited similar prevalence of baseline comorbidities and healthcare utilization.

To minimize potential selection bias, PSM was performed with a 1:4 matching ratio for the GEJ cohort—applied to enhance the robustness of the subgroup analysis and optimize risk estimate precision given its smaller sample size—resulting in a matched cohort of 1,739 patients in the GEJ+WM group and 6,956 in the WM group. Post-matching, all SMDs for sex, age, comorbidities, and healthcare utilization were significantly reduced (all SMDs < 0.06), indicating a highly balanced baseline for subsequent comparative outcome analyses.

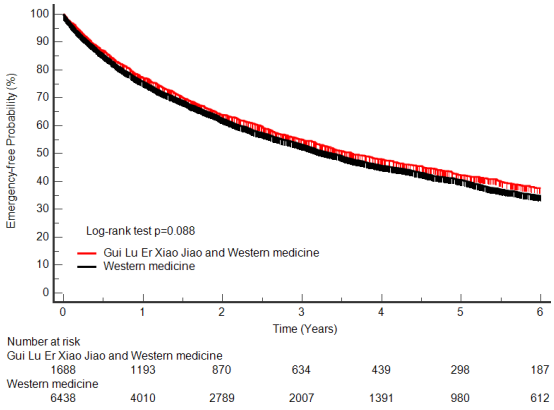
5. Kaplan-Meier and Cox Proportional

Hazards Analysis of GEJ Treatment on ED Visits and Hospitalization Rates

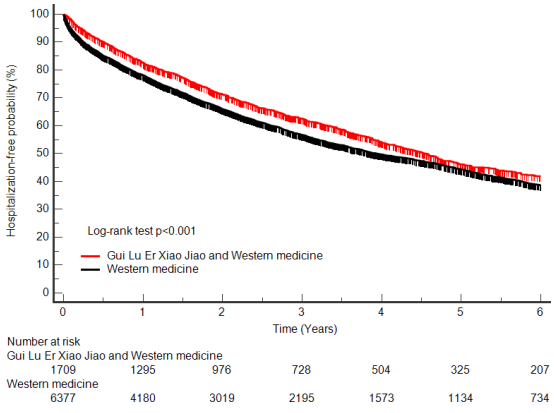
To mitigate immortal time bias, a 28-day landmark analysis was applied, symmetrically excluding patients with events or censoring within this period. Covariate balance was maintained after this adjustment, with all SMDs remaining below 0.1. K-M survival curves were used to evaluate the effect of the GEJ+WM group on the probability of remaining free from ED visits and hospitalizations. The results showed that the GEJ+WM group exhibited a significantly higher hospitalization-free probability compared to the WM group (log-rank p <0.001), but no significant difference in ED visit-free probability (log-rank p =0.088).

Because baseline covariates were already balanced via PSM, the univariate (crude) Cox proportional hazards models based on the matched cohort directly demonstrated that the GEJ+WM group was associated with a significant reduction in the risk of hospitalizations (HR=0.861; 95% CI: 0.794 to 0.933; p <0.001).

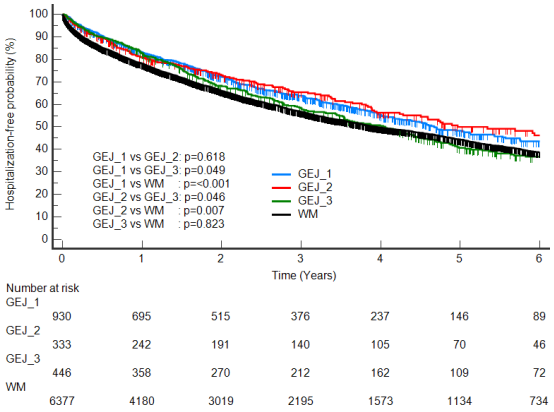
To further mitigate potential immortal time bias, a sensitivity analysis regarding intervention timing for hospitalization risk revealed that the protective benefits were significant with immediate (0 days) (HR: 0.822; 95% CI: 0.738–0.916; p <0.001) and early (≤3 months) (HR: 0.787; 95% CI: 0.661–0.936; p = 0.007) initiation of GEJ (Figure 3C). In contrast, delayed intervention (>3 months) did not yield a statistically significant



(A) Kaplan-Meier curves for ED visit-free probability



(B) Kaplan-Meier curves for hospitalization-free probabilities.



(C) Kaplan-Meier curves for hospitalization-free probabilities stratified by TCM intervention timing. (GEJ_1: Immediate Intervention, 0 days from MJOA diagnosis to TCM initiation; GEJ_2: Early Intervention, ≤3 months; GEJ_3: Delayed Intervention, >3 months)

Figure 3. Cumulative ED visit-free and hospitalization-free probabilities in elderly patients with MJOA: A comparison between GEJ plus WM and WM cohorts.

protective effect (HR: 0.983; 95% CI: 0.862–1.121; p = 0.798). These findings suggest a potential role for early GEJ intervention in reducing hospitalization risk among older patients with MJOA, particularly when integrated into the treatment plan shortly after diagnosis.

Discussion

To our knowledge, this is one of the few studies to provide robust evidence on the clinical impact of TCM among a notably elderly MJOA population, with a mean age of 73.7 years—a demographic highly susceptible to frailty and acute healthcare events. Our findings indicate that GEJ was the most frequently utilized formula for these patients. Following PSM adjustment and the application of a 28-day landmark analysis to rigorously mitigate ITB, CWM treatment significantly increased the hospitalization-free probability. For the GEJ subgroup, while initial observations suggested a protective trend against ED visits, this effect became statistically non-significant after ITB adjustment (p=0.088). In contrast, the significant reduction in hospitalization risk remained robust. Specifically, GEJ supplementation was associated with a significant 13.9% reduction in the risk of hospitalizations (HR=0.861; 95% CI: 0.794–0.933; p <0.001). This suggests that integrative TCM care may serve as a secondary prevention strategy for minimizing acute care utilization in the rapidly expanding super-aged population.

Crucially, our sensitivity analysis further demonstrated that these protective benefits against hospitalization were timing-dependent; immediate (0 days) or early (≤3 months) intervention was essential for significant risk reduction, whereas delayed intervention (>3 months) yielded no such benefit. To understand why such early intervention effectively lowers hospitalization rates, it is essential to examine the underlying drivers of acute healthcare utilization in older MJOA patients. The primary reasons for which older patients with MJOA seek emergency care or hospitalization extend beyond localized joint pain to include systemic complications such as infections and fractures. As recent evidence indicates, acute healthcare utilization in this population is primarily driven by systemic multimorbidity and care complexity rather than localized joint degradation [22]. Furthermore, recent studies have confirmed that the overlapping presence of osteoarthritis and osteosarcopenia significantly exacerbates the risk of frailty [7]. Therefore, effective osteoporosis management and sarcopenia prevention are essential for maintaining muscle strength and physiological function, reducing the risk of falls and related complications, and ultimately lowering the need for acute healthcare encounters [23].

To treat this complex interplay of osteoarthritis, osteoporosis, and musculoskeletal fatigue, GEJ, a traditional Chinese herbal formula made from tortoiseshell and deer antlers, is widely used. Its bone-strengthening properties make it a key nourishing remedy that aligns with the clinical need to address osteosarcopenia and systemic bone density loss [24]. GEJ has been shown in clinical practice to improve outcomes in older patients, including a significant enhancement of joint muscle strength and a notable reduction in joint pain [19]. Additionally, a study found that GEJ users had a lower incidence of lumbar vertebral fractures [20]. By potentially targeting both joint degeneration and physiological frailty, GEJ may reflect TCM's holistic approach to managing the

systemic vulnerabilities of MJOA.

The clinical efficacy of this holistic approach is strongly corroborated by underlying cellular and pharmacological mechanisms. Basic medical research has extensively explored the effects of tortoiseshell and deer antler gelatin on bone and cartilage cells. Specifically, the bioactive pentapeptide TSKYR and its derivatives (YR and TSK), which are derived from the collagen-rich components of these materials, serve as potent osteoblast-stimulating agents. These peptides have been confirmed to promote osteoblast mineralization and stimulate collagen synthesis by downregulating the NF-κB pathway, thereby regulating bone homeostasis and directly countering bone density loss [25, 26]. Furthermore, deer antler peptides have been shown to inhibit osteoclast differentiation. Studies have demonstrated that tortoiseshell gelatin enhances osteoblast viability and promotes calcium deposition, while deer antler gelatin exhibits stronger antioxidant capacity and improves chondrocyte viability. Therefore, the combined application of both is suggested to provide potential therapeutic benefits in addressing the dual burden of osteosarcopenia and joint degradation characteristic of MJOA.

While GEJ provides a foundational biological mechanism for bone and cartilage protection, clinical practice often necessitates a broader pharmacological approach to address the multifaceted symptoms of MJOA. According to our research, the most frequently prescribed TCM formulas identified in this study—including GEJ, Shu-Jing-Huo-Xue-Tang, Dang-Gui-Nian-Tong-Tang, and Du-Huo-Ji-Sheng-Tang—collectively enhance blood circulation, suppress inflammation, relieve joint pain and improve the quality of life of patient with MJOA [27, 28]. The most frequently used single herbs in this study, such as Du-Zhong [42], Dan-Shen [45], and Zhe-Bei-Mu [47-49], have been shown to potentially mitigating systemic low-grade inflammation by inhibiting key inflammatory cytokines, including TNF-α, IL-6, and COX-2. Crucially, these interventions target not only localized symptoms but also help mitigate the systemic low-grade inflammation associated with MJOA. The possible mechanisms of frequently used CHPs for MJOA are presented in Table 4.

Furthermore, the therapeutic scope of TCM in treating MJOA extends beyond musculoskeletal symptoms to encompass the management of age-related multimorbidity, which is the primary driver of acute healthcare utilization in older adults [22]. For example, Ji-Sheng-Shen-Ci-Wan aids in urinary function regulation and low back pain [29], while Xiang-Sha-Liu-Jun-Zi-Tang, Ban-Xia-Xie-Xin-Tang, and Ma-Zi-Ren-Wan optimize digestive function, alleviate gastrointestinal discomfort, and relieve constipation [30, 31]. Meanwhile, Jia-Wei-Xiao-Yao-San and Suan-Zao-Ren-Tang are primarily used for emotional regulation and sleep improvement, making them suitable for patients experiencing chronic disease-related anxiety and insomnia [32, 33]. By proactively addressing these extra-articular health needs, TCM may help mitigate the physiological decompensation that often precipitates hospital admissions.

In conclusion, our findings show that a combined treatment strategy—with GEJ as the main remedy—can manage both joint degeneration and physical weakness in elderly patients with MJOA. By combining specialized formulas to relieve musculoskeletal pain and other chronic health problems, this approach leads to significant reductions in hospitalization risk, if started early in the disease course.

This study has several limitations. First, conducted

Table 4. Possible mechanisms of frequently used CHPs for patients > 65 years old with MJOA.

Single or Formula CHPs	Known active herb constituents and formula ingredients	Possible pharmacological effects on MJOA
Gui-Lu-Er-Xian-Jiao	*Plastrum Testudinis; Cornu Cervi; Fructus Lycii; Radix Ginseng*	The pentapeptide TSKYR and its derivatives enhance osteoblast mineralization, collagen synthesis, and regulate bone homeostasis [25]. Extracts of *Plastrum Testudinis* inhibit osteoclast differentiation via the NF-κB signaling pathway and ameliorate senile osteoporosis, and also ameliorate oxidative stress in nucleus pulposus cells via downregulating the TNF-α signaling pathway [34, 35]. *Cornu Cervi* extracts reduced levels of TNF-α, IL-1β, IL-6, and PGE_2 [36].
Shu-Jing-Huo-Xue-Tang	*Angelicae Sinensis Radix; Rehmanniae Radix; Atractylodis Rhizoma; Chuanxiong Rhizoma; Persicae Semen; Poria, sclerotium; Paeoniae Radix Alba; Cyathulae Radix; Clematidis Radix; Stephaniae Tetrandrae Radix; Notopterygii Rhizoma et Radix; Saposhnikoviae Radix; Gentianae Radix ; Zingiberis Rhizoma Recens; Citri Reticulatae Pericarpium Vetum; Angelicae; Dahuricae Radix; Glycyrrhizae Radix*	The marker compound paeoniflorin has anti-inflammatory and immunoregulatory effects [37]. Fangchinoline and Genistein exerts anti-inflammatory effects through antioxidation, inhibition of inflammatory factors (TNF-α, IL-6, MMP-3, PGE2), and regulation of intracellular ROS [38, 39].
Dang-Gui-Nian-Tong-Tang	*Angelicae Sinensis Radix; Notopterygii Rhizoma et Radix; Glycyrrhizae Radix; Scutellariae Radix; Artemisiae Herba; Radix Ginseng; Sophora flavescens; Cimicifugae Rhizoma; Puerariae Radix; Atractylodis Rhizoma; Atractylodis Macrocephalae Rhizoma; Alismatis Rhizoma Polyporus, sclerotium; Saposhnikoviae Radix; Anemarrhenae Rhizoma*	Reduce serum inflammatory cytokine concentrations and mitigate cartilage damage by regulating the PERK/BiP pathway [40]. Reduce serum MMP-3 concentrations to alleviate cartilage damage [41].

Table 4. Possible mechanisms of frequently used CHPs for patients > 65 years old with MJOA. (Continued)

Single or Formula CHPs	Known active herb constituents and formula ingredients	Possible pharmacological effects on MJOA
Du-Zhong	*Eucommia ulmoides* Oliv. bark	Inhibits TNF-α, IL-6, COX-2, PGE_2, and NF-κB, reducing inflammatory responses [42]. With anti-osteoporosis effects through the MAPK pathway [43].
Dan-Shen	*Savia mitilorrhiza* Bunge, rhizome	Activates blood circulation and removes blood stasis, promoting local blood flow and reducing joint swelling and stiffness [44]. Regulates inflammatory responses through IL-17 and TNF [45]. Reduces blood viscosity and improves joint microcirculation [46].
Zhe-Bei-Mu	*Fritillaria thunbergii* Miq.	Peimine reduces MMP activity to prevent cartilage degradation. It inhibits TNF-α and decreases COX-2 and PGE_2 concentrations, alleviating pain and inflammation [47-49].

within Taiwan's healthcare system where TCM is heavily subsidized by National Health Insurance (NHI), this study's generalizability to Western nations may be limited. Under Taiwan's NHI system, routine clinical practice requires follow-ups every 2 to 4 weeks for GEJ prescriptions or other CHPs products, ensuring high adherence and reliable data capture. In contrast, where TCM requires out-of-pocket payment, financial barriers could compromise long-term compliance and the feasibility of early intervention. Second, regarding patient selection, we specifically targeted the ICD-10 code M15 (polyosteoarthritis) to capture the systemic and multimorbid phenotype of MJOA. Consequently, our findings may not be directly applicable to patients with simple, localized joint degeneration (e.g., M16–M19). Third, the specific clinical reasons for ED visits and hospitalizations were not analyzed, and these acute events were not stratified by osteoarthritis-related causes due to the limitations of routine clinical coding, highlighting the need for future cause-specific research. Fourth, lifestyle factors—such as diet, exercise, smoking, and alcohol consumption—could not be comprehensively assessed through the database. Additionally, the timing of intervention might be influenced by patient preference or disease progression, necessitating prospective research to determine the optimal therapeutic window. Moreover, while systemic comorbidities and baseline healthcare utilization were used as proxies, the study did not directly incorporate localized structural joint severity or radiological staging, which may serve as a critical confounder. Finally, although we applied rigorous PSM to balance baseline comorbidities and employed a 28-day landmark analysis to mitigate ITB, causal relationships cannot be

definitively established. Residual confounding related to health-seeking behavior, socioeconomic status, and unmeasured lifestyle factors cannot be completely excluded.

While TCM may show significant potential for managing the complex vulnerabilities of MJOA, further prospective studies are needed to confirm its impact on reducing emergency visits and hospitalizations. Investigating the synergistic effects of early TCM intervention combined with Western medicine—particularly in addressing osteosarcopenia and physical weakness—could optimize integrative treatment outcomes. Large-scale, randomized controlled trials are essential to provide high-quality evidence on the efficacy and safety of TCM, strengthening its role in modern geriatric care.

Conclusions

This study demonstrates that integrating TCM with Western medicine is associated with a lower hospitalization risk in older patients with multi-joint osteoarthritis (MJOA). Specifically, the use of GEJ as a foundational therapy is linked to this reduced risk, potentially by addressing the dual burden of joint degeneration and osteosarcopenia. Crucially, these protective benefits are highly dependent on early intervention (within 3 months of diagnosis), reflecting TCM's holistic efficacy in reducing systemic low-grade inflammation and managing the broader burden of geriatric multimorbidity. Further large-scale, randomized controlled trials are warranted to validate these findings and optimize integrative treatment strategies aimed at preventing severe health decline and reducing acute healthcare burdens in aging populations.

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References

1. Sinusas K. Osteoarthritis: diagnosis and treatment. *Am Fam Physician*. 2012; 85(1): 49-56.
2. Yan H, Guo J, Zhou W, Dong C, Liu J. Health-related quality of life in osteoarthritis patients: a systematic review and meta-analysis. *Psychol Health Med*. 2022; 27(8): 1859-1874.
3. Schepman P, Robinson R, Blakeman KH, Wilhelm S, Beck C, Hallberg S, et al. Factors influencing quality of life in patients with osteoarthritis: analyses from the BISCUITS study. *Scand J Pain*. 2023; 23(1): 139-148.
4. Nelson AE, Smith MW, Golightly YM, Jordan JM. "Generalized osteoarthritis": a systematic review. *Semin Arthritis Rheum*. 2014; 43(6): 713-720.
5. Walrabenstein W, Wagenaar CA, van de Put M, van der Leeden M, Gerritsen M, Twisk JWR, et al. A multidisciplinary lifestyle program for metabolic

syndrome-associated osteoarthritis: the "Plants for Joints" randomized controlled trial. *Osteoarthritis Cartilage*. 2023;31(11):1491-500.

6. Lynskey SJ, Macaluso MJ, Gill SD, McGee SL, Page RS. Biomarkers of Osteoarthritis-A Narrative Review on Causal Links with Metabolic Syndrome. *Life (Basel)*. 2023; 13(3): 730.
7. Liu J, Xia X, Wang Z, Wang Y, Qin G. Osteosarcopenia, osteoarthritis and frailty: a two-sample Mendelian randomization study. *Aging Clin Exp Res*. 2025; 37(1): 132.
8. Platzer H, Gantz S, Farber B, Moradi B. Rising direct medical costs of osteoarthritis in Germany from 2002 to 2020: trends, demographic drivers, and public health considerations. *Front Public Health*. 2025; 13: 1627510.
9. Kan HS, Chan PK, Chiu KY, Yan CH, Yeung SS, Ng YL, et al. Non-surgical. treatment of knee osteoarthritis. *Hong Kong Med J*. 2019; 25(2): 127-133.
10. Taruc-Uy RL, Lynch SA. Diagnosis and treatment of osteoarthritis. *Prim Care*. 2013; 40(4): 821-36, vii.
11. Skou ST, Roos EM. Physical therapy for patients with knee and hip osteoarthritis: supervised, active treatment is current best practice. *Clin Exp Rheumatol*. 2019; 37 Suppl 120(5): 112-117.
12. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019. American college of rheumatology/arthritis foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis Rheumatol*. 2020; 72(2): 220-233.
13. Zhou G, Zhang X, Gu Z, Zhao J, Luo M. Research progress in single-herb. Chinese medicine and compound medicine for knee osteoarthritis. *Comb Chem High Throughput Screen*. 2024; 27(15): 2180-2186.
14. Shi X, Wu P, Jie L, Zhang L, Mao J, Yin S. Integrated serum metabolomics and network pharmacology to reveal the interventional effects of Quzhi Decoction against osteoarthritis pain. *Int J Anal Chem*. 2022; 2022: 9116175.
15. Hospital CGM. Chang Gung Memorial Hospital Introduction 2023. Available from: https://www.cgmh.org.tw/tw/Systems/Overview.
16. Tsai MS, Lin MH, Lee CP, Yang YH, Chen WC, Chang GH, et al. Chang Gung. Research Database: A multi-institutional database consisting of original medical records. *Biomed J*. 2017; 40(5): 263-269.
17. Mi X, Hammill BG, Curtis LH, Lai EC, Setoguchi S. Use of the landmark. method to address immortal person-time bias in comparative effectiveness research: a simulation study. *Stat Med*. 2016; 35(26): 4824-4836.
18. Andrade C. Immortal time bias in cohort studies: A concept simply explained. *Indian J Psychol Med*. 2025; 47(4): 408-409.
19. Tsai CC, Chou YY, Chen YM, Tang YJ, Ho HC, Chen DY. Effect of the herbal drug guilu erxian jiao on muscle strength, articular pain, and disability in elderly men with knee osteoarthritis. *Evid Based Complement Alternat Med*. 2014; 2014: 297458.
20. Lai YX, Tseng CY, Yang HY, Yang SH, Lee PW, Yang TH. Effect assessment of traditional Chinese medicine, Guilu Erxian Jiao, in patients with osteoporosis: A case-control study of the Chang gung memorial hospital. *Explore (NY)*. 2024; 20(5): 102978.
21. Choi YY, Jin SC, Song M, Yi S, Park J, Baek HK, et al. Cervus elaphus sibiricus (deer antler) extract alleviates osteoporosis via dual modulation of osteoblast and osteoclast activity in ovariectomy-

induced mice on network pharmacology. *Journal of Ethnopharmacology*. 2026; 355(Pt A): 120669.

22. Platzer H, Gantz S, Färber B, Moradi B. Rising direct medical costs of osteoarthritis in Germany from 2002 to 2020: trends, demographic drivers, and public health considerations. *Frontiers in Public Health*. 2025; 13: 1627510.
23. Chattaris T, Oh G, Gouskova NA, Kim DH, Kiel DP, Berry SD. Osteoporosis medications prevent subsequent fracture in frail older adults. *J Bone Miner Res*. 2022;37(11):2103-11.
24. Ji-Qun X. Chinese Herbal Formulas2002 2002/10/01.
25. Ho TJ, Tsai WT, Wu JR, Chen HP. Biological activities of deer antler-derived peptides on human chondrocyte and bone metabolism. *Pharmaceuticals (Basel)*. 2024;17(4).
26. Chung KT, Wu HM, Lee MC, Chuang WC, Wu CH. Therapeutic Potential of Bioactive Peptides Derived from Natural Products of Tortoiseshell and Antler in Alleviating Osteoporosis and Osteoarthritis. *International Journal of Molecular Sciences*. 2025;26(2).
27. Shu H, Arita H, Hayashida M, Zhang L, An K, Huang W, et al. Anti-hypersensitivity effects of Shu-jing-huo-xue-tang, a Chinese herbal medicine, in CCI-neuropathic rats. *J Ethnopharmacol*. 2010;131(2):464-470.
28. Chen WJ, Zhuang Y, Peng W, Cui W, Zhang SJ, Wang JW. Du Huo Ji Sheng Tang inhibits Notch1 signaling and subsequent NLRP3 activation to alleviate cartilage degradation in KOA mice. *Chin Med*. 2023; 18(1): 80.
29. Yagi H, Nishio K, Sato R, Arai G, Soh S, Okada H. Clinical efficacy and tolerability of Gosha-jinki-gan, a Japanese traditional herbal medicine, for nocturia. *J Tradit Complement Med*. 2016;6(1):126-129.
30. Zhang J, Wang X, Wang F, Tang X. Xiangsha Liujunzi Decoction improves gastrointestinal motility in functional dyspepsia with spleen deficiency syndrome by restoring mitochondrial quality control homeostasis. *Phytomedicine*. 2022; 105: 154374.
31. Zhong LLD, Cheng CW, Kun W, Dai L, Hu DD, Ning ZW, et al. Efficacy of MaZiRenWan, a Chinese herbal medicine, in patients with functional constipation in a randomized controlled trial. *Clin Gastroenterol Hepatol*. 2019; 17(7): 1303-10.e18.
32. Hu J, Teng J, Wang W, Yang N, Tian H, Zhang W, et al. Clinical efficacy and safety of traditional Chinese medicine Xiao Yao San in insomnia combined with anxiety. *Medicine (Baltimore)*. 2021; 100(43): e27608.
33. Mahmoudi R, Ansari S, Haghighizadeh MH, Maram NS, Montazeri S. Investigation the effect of jujube seed capsule on sleep quality of postmenopausal women: A double-blind randomized clinical trial. *Biomedicine (Taipei)*. 2020; 10(4): 42-48.
34. Chen H, Shen G, Shang Q, Zhang P, Yu D, Yu X, et al. Plastrum testudinis extract suppresses osteoclast differentiation via the NF-κB signaling pathway and ameliorates senile osteoporosis. *J Ethnopharmacol*. 2021; 276: 114195.
35. Zhang P, He J, Gan Y, Shang Q, Chen H, Zhao W, et al. Plastrum testudinis ameliorates oxidative stress in nucleus pulposus cells via downregulating the TNF-α signaling pathway. *Pharmaceuticals (Basel)*. 2023;16(10): 1482.
36. Kim HR, Lee SH, Noh EM, Choi B, Seo HY, Jang H, et al. Therapeutic Effect of Enzymatically Hydrolyzed Cervi Cornu Collagen NP-2007 and Potential for Application in Osteoarthritis Treatment. *Int J Mol Sci*. 2023; 24(14):11667.
37. Zhang L, Wei W. Anti-inflammatory and

immunoregulatory effects of. paeoniflorin and total glucosides of paeony. *Pharmacol Ther*. 2020; 207: 107452.

38. Sharifi-Rad J, Quispe C, Imran M, Rauf A, Nadeem M, Gondal TA, et al. Genistein: An integrative overview of its mode of action, pharmacological properties, and health benefits. *Oxid Med Cell Longev*. 2021; 2021: 3268136.
39. Shan L, Tong L, Hang L, Fan H. Fangchinoline supplementation attenuates inflammatory markers in experimental rheumatoid arthritis-induced rats. *Biomed Pharmacother*. 2019; 111: 142-150.
40. Youwei Z, Xiaohong L, Kai L. An experimental study of danggui niantong. decoction regulating PERK/Bip pathway to reduce cartilage injury in rats with knee osteoarthritis. *Journal of Liaoning University of Traditional Chinese Medicine*. 2023; 25(5): 34-38+221.
41. Li-ping A, Peng C, Hui L. Effects of dangguiniantong decoction on MMP-3. expression in adjuvant arthritis rats serum. *Journal of Emergency in Traditional Chinese Medicine*. 2009; 18(11): 1851-1853.
42. Kim MC, Kim DS, Kim SJ, Park J, Kim HL, Kim SY, et al. Eucommiae cortex inhibits TNF-α and IL-6 through the suppression of caspase-1 in. lipopolysaccharide-stimulated mouse peritoneal macrophages. *Am J Chin Med*. 2012; 40(1): 135-149.
43. Zhou L, Wu T. A network pharmacology-based study on vital pharmacological pathways and targets of eucommiae cortex acting on osteoporosis. *Biomed Res Int*. 2022; 2022: 8510842.
44. Ye Z, Liu Y, Song J, Gao Y, Fang H, Hu Z, et al. Expanding the therapeutic. potential of Salvia miltiorrhiza: a review of its pharmacological applications in musculoskeletal diseases. *Front Pharmacol*. 2023; 14: 1276038.
45. Jiang R, Zhang X, Li Y, Zhou H, Wang H, Wang F, et al. Identification of the molecular mechanisms of Salvia miltiorrhiza relevant to the treatment of osteoarthritis based on network pharmacology. *Discov Med*. 2020; 30(160): 83-95.
46. Ma J, Chen X, Bian YQ, Chen ZJ, Qiao YJ, Zhang YL. Study on efficacy markers of Salviae Miltiorrhizae Radix et Rhizoma for promoting blood circulation and remving blood stasis based on systematic traditional Chinese medicine. *Zhongguo Zhong Yao Za Zhi*. 2020; 45(14): 3259-3265.
47. Chen K, Lv ZT, Zhou CH, Liang S, Huang W, Wang ZG, et al. Peimine suppresses interleukin-1β-induced inflammation via MAPK downregulation in chondrocytes. *Int J Mol Med*. 2019; 43(5): 2241-2251.
48. Zhou J, Mao Y, Shi X, Zhang Y, Yu X, Liu X, et al. Peimine suppresses collagen-induced arthritis, activated fibroblast-like synoviocytes and TNFα-induced MAPK pathways. *Int Immunopharmacol.* 2022; 111: 109181.
49. Yi PF, Wu YC, Dong HB, Guo Y, Wei Q, Zhang C, et al. Peimine impairs pro-inflammatory cytokine secretion through the inhibition of the activation of NF-κB and MAPK in LPS-induced RAW264.7 macrophages. *Immunopharmacol Immunotoxicol*. 2013; 35(5): 567-572.
50. Zhuo Q, Yang W, Chen J, Wang Y. Metabolic syndrome meets osteoarthritis. *Nat Rev Rheumatol*. 2012;8(12):729–737.
51. Brignardello-Petersen R, Guyatt GH, Buchbinder R, et al. Knee arthroscopy versus conservative management in patients with degenerative knee disease: a systematic review. *BMJ Open*. 2017;7(5):e016114.

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原始論文

中醫治療對高齡多關節骨關節炎急性醫療事件之保護效果：一項真實世界證據研究

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目的：探討中西醫結合治療對老年多關節骨關節炎（MJOA）患者急診與住院風險之影響及中藥效益。 **方法：**回溯性世代研究，納入 2016至 2022年 ≥65歲 MJOA患者（平均年齡 73.6歲），分為純西醫組（WM, 7848人）與中西醫合併組（CWM, 2306人）。採 28天地標分析（Landmark analysis）以消除不死時間偏誤（immortal time bias, ITB)，以傾向分數配對（PSM）平衡基線。用單變量 Cox模型評估風險比（HR），並對龜鹿二仙膠（GEJ）進行亞組分析。**結果：**校正ITB後，與WM組比較，CWM組顯著降低住院風險（HR=0.873；95% CI：0.812 to 0.939；p<0.001），急診風險無顯著差異。GEJ亞組亦顯著降低住院風險（HR=0.861；95% CI：0.794 to 0.933；p <0.001），而急診風險下降趨勢未達顯著（p=0.088）。中醫藥介入時間分析顯示：即時（0天）或早期（≤3個月）介入可顯著降低住院風險，延遲（>3個月）則無益處。**結論：**中西醫結合與高齡 MJOA患者住院風險的顯著降低相關。核心處方GEJ可能透過緩解關節退化與骨肉減少症展現保護力。本研究支持中醫藥作為老年MJOA的輔助療法，更強調及早中醫藥介入對於高齡 MJOA患者降低急性醫療負擔的價值。

關鍵字：多關節骨關節炎、高齡者、中醫藥、龜鹿二仙膠、住院率

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