

Reported Western, traditional, complementary, and integrative pain-management patterns and later pain severity among Chinese adults with musculoskeletal pain: a prospective CHARLS cohort study

Yihao Zhou

First Affiliated Hospital of Hunan University of Traditional Chinese Medicine

Haobo Jiang

Hunan University of Traditional Chinese Medicine

Wensi Ouyang

Hunan University of Traditional Chinese Medicine

Yi Yu

First Affiliated Hospital of Hunan University of Traditional Chinese Medicine

Shijia Xu

Hunan University of Traditional Chinese Medicine

Long Chen

First Affiliated Hospital of Hunan University of Traditional Chinese Medicine

Zhaoyong Li

First Affiliated Hospital of Hunan University of Traditional Chinese Medicine

Shaofeng Yang

ysf574996585@163.com

First Affiliated Hospital of Hunan University of Traditional Chinese Medicine

Research Article

Keywords: musculoskeletal pain, complementary medicine, traditional Chinese medicine, integrative medicine, healthcare utilization, longitudinal study, CHARLS

Posted Date: October 22nd, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10524654/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Pain care in China is pluralistic: adults may use Western medicine, Chinese medicine, acupuncture, professional massage, or combinations of these measures. Existing CHARLS studies have mainly characterized cross-sectional utilization of individual modalities. We examined whether mutually exclusive Western-medicine-only, traditional/complementary, and integrative management-use patterns were associated with pain severity at a subsequent survey wave.

Methods

We conducted a prospective observational cohort study using the 2018 and 2020 waves of the China Health and Retirement Longitudinal Study (CHARLS). Participants were aged at least 45 years, rated baseline pain as at least “somewhat,” and reported at least one musculoskeletal pain site. Four baseline patterns were defined: no reported pain-relief measure, Western medicine only, traditional/complementary modalities without Western medicine, and integrative management. The primary outcome was five-level pain severity in 2020. We fitted a proportional-odds model after multiple imputation using the 2018 cross-sectional individual weight and adjusted for sociodemographic factors, baseline pain burden, health, psychological and functional status, and healthcare use. Attrition weighting was examined in a prespecified sensitivity analysis.

Results

The primary cohort included 3,462 participants; 3,237 had valid survey weights and contributed to the primary model. The global association of management pattern with later pain severity was statistically significant ($P = 0.002$). Relative to no reported measure, the adjusted cumulative odds ratio (OR) for a higher pain-severity category was 1.33 (95% CI 1.13–1.57) for Western medicine only and 1.30 (95% CI 1.08–1.57) for integrative management. The estimate for traditional/complementary modalities without Western medicine was 1.10 (95% CI 0.85–1.43). The combined cross-sectional and attrition-weight sensitivity estimates were materially unchanged. Global tests for secondary pain and functional outcomes did not show clear differences among patterns.

Conclusions

Among middle-aged and older Chinese adults with musculoskeletal pain, Western-medicine-only and integrative management-use patterns were associated with greater subsequent ordinal pain severity. These reported utilization patterns may mark a clinically complex, high-burden population warranting continued assessment and coordinated care; they should not be interpreted as evidence of benefit, harm, or comparative effectiveness.

Clinical trial registration

Clinical trial number: not applicable. This study was an observational secondary analysis of CHARLS cohort data and did not involve the assignment of participants to any intervention.

BACKGROUND

Musculoskeletal pain is common among middle-aged and older adults and contributes substantially to disability [1–3]. In China, the relevant public-health question extends beyond burden because pain is managed within a pluralistic system in which Western, traditional, and complementary approaches may be used separately or together. Characterizing these utilization patterns can inform service planning and coordinated care without implying that any modality is effective.

Within this pluralistic environment, people may report Western medicine, Chinese medicine, acupuncture, professional massage, or combinations of these measures. A 2018 CHARLS study described utilization of these modalities among 10,346 adults with musculoskeletal pain and identified characteristics associated with reported choices [4]. A later cross-sectional analysis of 7,929 adults with low back pain showed that acupuncture frequently co-occurred with massage, Chinese herbal medicine, and Western medication [5]. These studies established the prevalence and correlates of modality use, but they did not test whether mutually exclusive Western, traditional/complementary, and integrative patterns identify people with different subsequent pain burden.

This distinction matters because management use is not randomized. More severe, multisite, or persistent pain may prompt people to seek pharmacological or multimodal care, producing confounding by indication [6]. Consequently, observational associations between a reported management pattern and later pain cannot be interpreted as effectiveness. They may nevertheless have prognostic value by identifying people who remain at high risk of pain burden and require continued assessment.

We therefore examined associations between reported pain-management patterns in CHARLS 2018 and overall pain severity in 2020. We hypothesized that patterns involving medication or multiple modalities would identify participants with higher subsequent pain severity after adjustment for baseline pain burden and other measured characteristics. Secondary objectives were to examine pain reported at both waves and incident functional limitations.

METHODS

Study design and data source

This prospective observational cohort study used the 2018 and 2020 waves of CHARLS. CHARLS is a nationally representative longitudinal survey of community-dwelling Chinese adults aged 45 years or older and their spouses. It uses multistage probability sampling and repeated computer-assisted interviews covering health, functioning, healthcare use, work, and socioeconomic circumstances [2]. The study was reported in accordance with the STROBE statement [7].

Participants

The 2018 health interview contained 19,752 records. We included participants who were aged at least 45 years, rated overall pain as at least “somewhat” (response categories 3–5), reported at least one musculoskeletal pain site, had complete and internally consistent management indicators, linked to the 2020 health interview, and had valid 2020 pain severity data. Musculoskeletal sites were the shoulder, arm, wrist, fingers, back, waist, buttocks, leg, knee, ankle, toes, and neck. Head, chest, stomach, and unspecified other sites were not counted as musculoskeletal sites.

For the primary analysis, we excluded people reporting an unspecified “other” pain-relief measure because its clinical content could not be determined. We also excluded proxy responses to the 2018 or 2020 health modules because pain severity is subjective. Both groups were restored in prespecified sensitivity analyses. Figure 1 shows the complete cohort construction.

Reported pain-management patterns

The 2018 questionnaire asked respondents whether they had taken any of several measures to relieve pain; multiple responses were permitted. Separate indicators identified Chinese medicine, Western medicine, acupuncture, professional massage, other measures, and no measure. We constructed four mutually exclusive, clinically interpretable patterns:

1. no reported pain-relief measure;
2. Western medicine only;
3. traditional/complementary modalities without Western medicine (at least one of Chinese medicine, acupuncture, or professional massage); and
4. integrative management (Western medicine plus at least one traditional/complementary modality).

“No reported pain-relief measure” was the reference group. The questionnaire did not capture the start date, dose, frequency, duration, provider, adherence, or whether a measure was continued during follow-up.

Outcomes

The primary outcome was five-level overall pain severity in 2020: none, a little, somewhat, quite a bit, or very. Higher categories represented greater pain burden.

Secondary outcomes were pain rated at least “somewhat” in 2020; at least one baseline musculoskeletal pain site reported again in 2020; the number of baseline musculoskeletal pain sites reported again; incident limitation in activities of daily living (ADL); and incident limitation in instrumental ADL (IADL). We used “reported at both waves” rather than “continuous pain,” because the survey did not observe pain between visits. Incident ADL and IADL outcomes were assessed only among participants without the respective limitation at baseline. A comparable 2018–2020 mobility scale was unavailable, so mobility was not analyzed as an incident outcome.

Covariates

Covariates were selected a priori and were not chosen using univariable P values, stepwise procedures, or machine learning. Demographic and socioeconomic covariates were age, sex, education, marital/partner status, rural residence, respondent-and-spouse wealth, and health-insurance coverage. Pain variables were baseline overall pain severity, musculoskeletal pain-site count, and indicators for back/waist, knee, and neck/shoulder pain. Health variables were doctor-diagnosed arthritis/rheumatism, chronic-disease count excluding arthritis, the most recent pre-baseline measured body mass index (2015), and self-rated health. Additional covariates were the 10-item Center for Epidemiologic Studies Depression score, baseline ADL and IADL limitation counts, any outpatient visit in the previous month, and any hospital admission in the previous year. Wealth was inverse-hyperbolic-sine transformed for modelling. As an outcome-blind data-quality rule, measured BMI values below 10 or above 60 kg/m² were recoded to missing before imputation.

Statistical analysis

Baseline characteristics are presented as unweighted counts and percentages or means and standard deviations; wealth is summarized by median and interquartile range. The primary association was estimated using a survey-weighted proportional-odds cumulative logit model with the 2018 individual cross-sectional weight adjusted for household and individual nonresponse (INDV_weight_ad2; harmonized as r4wtrespb) and community-level clustering [8]. CHARLS does not provide an official individual longitudinal weight after Wave 2. The model included all prespecified covariates. We report adjusted cumulative ORs with 95% confidence intervals and a global Wald test for the exposure. An OR greater than 1 indicates higher odds of being in a more severe pain category. Direction and magnitude across binary cumulative cut points were inspected as a diagnostic for the proportional-odds summary [9]. Because a survey-compatible partial proportional-odds procedure was not available for this multiply imputed, weighted design, these cut-point models were used as the prespecified diagnostic rather than as separate primary hypotheses.

Missing covariates were handled by multiple imputation using chained equations with 20 imputed datasets [10]. Exposure, outcome, survey weight, and cluster were not imputed. Because 225 cohort members lacked a valid cross-sectional individual weight, the survey-weighted primary model included 3,237 participants.

We assessed differential observation of the 2020 pain outcome among all 5,461 participants who satisfied the baseline age, pain, musculoskeletal-site, and management-indicator criteria. Retained and non-retained participants were compared using absolute standardized mean differences. Within each imputed dataset, a prespecified logistic model estimated the probability of a valid 2020 pain outcome from management pattern and baseline covariates. Stabilized inverse probability-of-observation weights were truncated at the 1st and 99th percentiles and multiplied by the 2018 cross-sectional weight; the combined weight was normalized before refitting the primary model. Untruncated combined weights, observation weights alone, cross-sectional weights alone, and an unweighted analysis were also examined. Weight positivity, coefficient of variation, and effective sample size were reported.

Secondary binary outcomes were modelled with survey-weighted modified Poisson regression and robust variance to estimate adjusted risk ratios [11]. The count of baseline pain sites reported again was modelled

with a survey-weighted count model. Prespecified sensitivity analyses included unweighted multiply imputed models, survey-weighted complete-case analysis, restoration of proxy interviews, restoration of the other-containing group, alternative baseline pain thresholds, and generalized propensity-score overlap weighting. Overlap balance was judged acceptable when the maximum absolute standardized mean difference was at most 0.10 [12]. All tests were two-sided. Analyses were performed in R 4.6.1. Secondary outcome analyses were exploratory. No adjustment was made for multiple comparisons; global exposure tests were prioritized over individual contrasts. In a post hoc exploratory analysis, effect modification by baseline pain severity ("somewhat," "quite a bit," or "very") was assessed with a global management-pattern-by-severity interaction in the fully adjusted ordinal model; stratum-specific estimates were reported for descriptive context.

Use of generative AI tools

OpenAI Codex was used to assist with statistical programming in R and language polishing. Codex-generated code was reviewed and validated by the authors against raw CHARLS data; all numerical results were independently verified. No AI tool meets the ICMJE authorship criteria.

RESULTS

Cohort and baseline characteristics

Of 19,752 health-interview records in 2018, 5,774 participants met the baseline age and pain-severity criteria. After pain-site, linkage, outcome, exposure, and proxy-response exclusions, the primary cohort included 3,462 participants (Fig. 1). The cohort had a mean age of 61.7 years (SD 9.3); 64.3% were women and 70.1% lived in rural areas.

Among 5,461 baseline-eligible participants, 599 did not have a valid 2020 pain outcome. Of these, 221 had a recorded death, 377 had no 2020 health interview and no known death record, and 1 completed the health interview but lacked a valid pain-severity outcome. Retained and non-retained participants differed most in baseline IADL burden, residence, ADL burden, and age; the maximum absolute standardized mean difference was 0.421 (Additional file 1, Table S2 and Figure S3).

The four management patterns comprised 1,038 participants reporting no measure, 1,183 reporting Western medicine only, 453 reporting traditional/complementary modalities without Western medicine, and 788 reporting integrative management. In the primary cohort, 1,971 (56.9%) reported Western medicine, 795 (23.0%) Chinese medicine, 543 (15.7%) acupuncture, and 461 (13.3%) professional massage; and responses were not mutually exclusive. Individual modality use and all mutually exclusive combinations within the traditional/complementary and integrative patterns are reported in Additional file 1, Table S5. Baseline burden was not exchangeable across groups. For example, the integrative group reported a mean of 6.1 musculoskeletal pain sites and 33.8% rated pain as "very," compared with 4.6 sites and 22.8%, respectively, in the no-measure group (Table 1).

Table 1
Baseline characteristics by reported pain-management pattern (unweighted)

Characteristic	Overall	No reported measure	Western medicine only	Traditional/complementary without Western medicine	Integrative management
Age, years	61.7 (9.3)	62.0 (9.5)	61.8 (9.2)	60.7 (9.0)	61.7 (9.1)
Sex					
Men	1237 (35.7%)	399 (38.4%)	419 (35.4%)	165 (36.4%)	254 (32.2%)
Women	2225 (64.3%)	639 (61.6%)	764 (64.6%)	288 (63.6%)	534 (67.8%)
Education					
No formal education	1072 (31.0%)	304 (29.3%)	406 (34.3%)	106 (23.4%)	256 (32.5%)
Primary or below	1583 (45.7%)	489 (47.1%)	528 (44.6%)	215 (47.5%)	351 (44.5%)
Middle school	543 (15.7%)	163 (15.7%)	168 (14.2%)	82 (18.1%)	130 (16.5%)
High/vocational school	239 (6.9%)	73 (7.0%)	74 (6.3%)	44 (9.7%)	48 (6.1%)
College or above	25 (0.7%)	9 (0.9%)	7 (0.6%)	6 (1.3%)	3 (0.4%)
Marital/partner status					
Not partnered	519 (15.0%)	159 (15.3%)	174 (14.7%)	55 (12.1%)	131 (16.6%)
Married/partnered	2943 (85.0%)	879 (84.7%)	1009 (85.3%)	398 (87.9%)	657 (83.4%)
Residence					
Urban	1035 (29.9%)	316 (30.4%)	285 (24.1%)	178 (39.3%)	256 (32.5%)
Rural	2427 (70.1%)	722 (69.6%)	898 (75.9%)	275 (60.7%)	532 (67.5%)
Respondent-and-spouse wealth (10 ⁴ yuan)	4.0 (0.5, 18.0)	4.2 (0.5, 20.2)	3.0 (0.3, 13.3)	7.9 (0.6, 28.7)	4.0 (0.6, 18.4)
Values are n (%) or mean (SD), except wealth, which is median (interquartile range). Percentages may not sum to 100 because of rounding. BMI was measured in 2015, the most recent measurement before the 2018 baseline.					

Characteristic	Overall	No reported measure	Western medicine only	Traditional/complementary without Western medicine	Integrative management
Missing	709	229	228	94	158
Any health insurance	3361 (97.1%)	1005 (96.8%)	1146 (97.0%)	440 (97.1%)	770 (97.7%)
Missing	2	0	2	0	0
Baseline overall pain severity					
Somewhat	1363 (39.4%)	489 (47.1%)	428 (36.2%)	209 (46.1%)	237 (30.1%)
Quite a bit	1145 (33.1%)	312 (30.1%)	399 (33.7%)	149 (32.9%)	285 (36.2%)
Very	954 (27.6%)	237 (22.8%)	356 (30.1%)	95 (21.0%)	266 (33.8%)
Musculoskeletal pain-site count	5.2 (3.2)	4.6 (2.9)	5.2 (3.2)	4.8 (3.0)	6.1 (3.3)
Back or waist pain	2772 (80.1%)	802 (77.3%)	931 (78.7%)	375 (82.8%)	664 (84.3%)
Knee pain	2093 (60.5%)	567 (54.6%)	739 (62.5%)	237 (52.3%)	550 (69.8%)
Neck or shoulder pain	2269 (65.5%)	634 (61.1%)	780 (65.9%)	287 (63.4%)	568 (72.1%)
Doctor-diagnosed arthritis/rheumatism	2149 (62.1%)	551 (53.1%)	767 (64.8%)	262 (57.8%)	569 (72.2%)
Chronic-disease count (excluding arthritis)	2.4 (1.9)	2.2 (1.8)	2.4 (1.8)	2.3 (1.9)	2.6 (1.9)
Latest measured BMI (2015), kg/m ²	24.0 (3.9)	23.8 (4.1)	24.1 (3.9)	24.3 (3.7)	24.0 (3.7)
Missing	674	198	212	105	159
Self-rated health					
Very good	109 (3.2%)	39 (3.8%)	36 (3.1%)	25 (5.6%)	9 (1.2%)
Good	178 (5.2%)	73 (7.1%)	50 (4.3%)	29 (6.5%)	26 (3.3%)
Values are n (%) or mean (SD), except wealth, which is median (interquartile range). Percentages may not sum to 100 because of rounding. BMI was measured in 2015, the most recent measurement before the 2018 baseline.					

Characteristic	Overall	No reported measure	Western medicine only	Traditional/complementary without Western medicine	Integrative management
Fair	1418 (41.4%)	455 (44.1%)	481 (41.3%)	193 (43.1%)	289 (37.0%)
Poor	1277 (37.3%)	347 (33.6%)	453 (38.9%)	151 (33.7%)	326 (41.7%)
Very poor	446 (13.0%)	118 (11.4%)	146 (12.5%)	50 (11.2%)	132 (16.9%)
Missing	34	6	17	5	6
CES-D 10 score	11.9 (7.0)	11.3 (7.0)	12.2 (7.1)	10.3 (6.7)	13.0 (6.9)
Missing	67	16	29	12	10
ADL limitation count					
0	2280 (65.9%)	729 (70.2%)	779 (65.9%)	315 (69.5%)	457 (58.0%)
1	528 (15.3%)	150 (14.5%)	179 (15.1%)	66 (14.6%)	133 (16.9%)
2	274 (7.9%)	72 (6.9%)	91 (7.7%)	26 (5.7%)	85 (10.8%)
3	167 (4.8%)	42 (4.0%)	56 (4.7%)	23 (5.1%)	46 (5.8%)
4	105 (3.0%)	20 (1.9%)	42 (3.6%)	8 (1.8%)	35 (4.4%)
5	72 (2.1%)	19 (1.8%)	23 (1.9%)	6 (1.3%)	24 (3.0%)
6	35 (1.0%)	6 (0.6%)	12 (1.0%)	9 (2.0%)	8 (1.0%)
Missing	1	0	1	0	0
IADL limitation count					
0	2183 (63.1%)	672 (64.7%)	737 (62.4%)	306 (67.5%)	468 (59.4%)
1	612 (17.7%)	185 (17.8%)	211 (17.9%)	75 (16.6%)	141 (17.9%)
2	315 (9.1%)	93 (9.0%)	118 (10.0%)	28 (6.2%)	76 (9.6%)
Values are n (%) or mean (SD), except wealth, which is median (interquartile range). Percentages may not sum to 100 because of rounding. BMI was measured in 2015, the most recent measurement before the 2018 baseline.					

Characteristic	Overall	No reported measure	Western medicine only	Traditional/complementary without Western medicine	Integrative management
3	187 (5.4%)	48 (4.6%)	64 (5.4%)	18 (4.0%)	57 (7.2%)
4	107 (3.1%)	29 (2.8%)	34 (2.9%)	19 (4.2%)	25 (3.2%)
5	57 (1.6%)	11 (1.1%)	18 (1.5%)	7 (1.5%)	21 (2.7%)
Missing	1	0	1	0	0
Outpatient visit in previous month	824 (23.8%)	167 (16.1%)	271 (22.9%)	128 (28.3%)	258 (32.8%)
Missing	4	0	2	1	1
Hospital stay in previous year	772 (22.3%)	203 (19.6%)	264 (22.4%)	96 (21.2%)	209 (26.6%)
Missing	4	0	2	1	1
Values are n (%) or mean (SD), except wealth, which is median (interquartile range). Percentages may not sum to 100 because of rounding. BMI was measured in 2015, the most recent measurement before the 2018 baseline.					

At follow-up, 1,895 participants (54.7%) rated pain as at least “somewhat,” and 2,486 (71.8%) reported at least one baseline pain site again.

Primary outcome

The management-pattern term was associated with 2020 ordinal pain severity in the fully adjusted survey-weighted model (global $P = 0.002$). Compared with no reported measure, Western medicine only was associated with higher cumulative odds of a more severe pain category (adjusted cumulative OR 1.33, 95% CI 1.13–1.57; $P < 0.001$). Integrative management showed a similar association (OR 1.30, 95% CI 1.08–1.57; $P = 0.006$). The estimate for traditional/complementary modalities without Western medicine was compatible with no clear difference (OR 1.10, 95% CI 0.85–1.43; $P = 0.462$) (Table 2; Fig. 2).

Table 2
Reported pain-management patterns and 2020 ordinal pain severity

Pain-management pattern	Cumulative OR	95% CI	P value
Western medicine only	1.33	1.13 to 1.57	< 0.001
Traditional/complementary modalities without Western medicine	1.10	0.85 to 1.43	0.462
Integrative management	1.30	1.08 to 1.57	0.006
ORs are adjusted cumulative odds ratios from the survey-weighted proportional-odds model with 20 imputed datasets. The reference is no reported pain-relief measure. The global exposure P value was 0.002. An OR above 1 indicates higher cumulative odds of being in a more severe pain category.			

Binary cut-point diagnostics were directionally consistent with the ordinal summary: ORs ranged from 1.26 to 1.40 for Western medicine only and from 1.22 to 1.54 for integrative management across progressively higher pain thresholds. The corresponding estimates for traditional/complementary modalities ranged from 0.92 to 1.28 (Additional file 1, Table S8).

In the post hoc effect-modification analysis, there was no evidence that the association between management pattern and later ordinal pain severity varied by baseline pain severity (global interaction $P = 0.942$; Additional file 1, Table S11).

Secondary outcomes

Global tests did not provide clear evidence of management-pattern differences for pain rated at least “somewhat” ($P = 0.135$), pain reported at both waves ($P = 0.131$), the number of baseline pain sites reported again ($P = 0.346$), incident ADL limitation ($P = 0.630$), or incident IADL limitation ($P = 0.085$) (Table 3). Among participants without baseline limitation, 608 of 2,280 developed ADL limitation and 475 of 2,183 developed IADL limitation.

Table 3
Secondary pain and functional outcomes

Outcome	Pain-management pattern	Adjusted ratio	95% CI	P value
Pain rated at least somewhat in 2020	Western medicine only	1.12	1.02 to 1.23	0.023
Pain rated at least somewhat in 2020	Traditional/complementary modalities without Western medicine	1.10	0.96 to 1.26	0.152
Pain rated at least somewhat in 2020	Integrative management	1.11	1.00 to 1.23	0.045
At least one baseline pain site reported in 2020	Western medicine only	1.07	1.00 to 1.15	0.044
At least one baseline pain site reported in 2020	Traditional/complementary modalities without Western medicine	1.02	0.92 to 1.13	0.687
At least one baseline pain site reported in 2020	Integrative management	1.08	1.00 to 1.16	0.036
Number of baseline pain sites reported in 2020	Western medicine only	1.06	0.96 to 1.18	0.262
Number of baseline pain sites reported in 2020	Traditional/complementary modalities without Western medicine	1.09	0.96 to 1.24	0.174
Number of baseline pain sites reported in 2020	Integrative management	1.09	0.99 to 1.21	0.093
Incident ADL limitation	Western medicine only	0.99	0.82 to 1.20	0.926
Incident ADL limitation	Traditional/complementary modalities without Western medicine	1.03	0.78 to 1.37	0.824
Incident ADL limitation	Integrative management	1.12	0.90 to 1.39	0.299
Incident IADL limitation	Western medicine only	0.78	0.63 to 0.97	0.024
Incident IADL limitation	Traditional/complementary modalities without Western medicine	0.75	0.55 to 1.03	0.072
Ratios are adjusted risk ratios for binary outcomes and an adjusted count ratio for the number of baseline pain sites reported in 2020. The reference is no reported pain-relief measure. These secondary analyses were exploratory; no adjustment was made for multiple comparisons, and global exposure tests were prioritized. Global exposure P values were 0.135, 0.131, 0.346, 0.630, 0.085 for the outcomes in their order of appearance.				

Outcome	Pain-management pattern	Adjusted ratio	95% CI	P value
Incident IADL limitation	Integrative management	0.90	0.71 to 1.12	0.345
Ratios are adjusted risk ratios for binary outcomes and an adjusted count ratio for the number of baseline pain sites reported in 2020. The reference is no reported pain-relief measure. These secondary analyses were exploratory; no adjustment was made for multiple comparisons, and global exposure tests were prioritized. Global exposure P values were 0.135, 0.131, 0.346, 0.630, 0.085 for the outcomes in their order of appearance.				

Sensitivity analyses

The main pattern was robust to unweighted analysis, complete-case analysis, restoration of proxy interviews, restoration of the other-containing group, and alternative baseline pain thresholds (Additional file 1, Table S7 and Figure S1). Stabilized observation weights were well-behaved (median coefficient of variation 0.101; median maximum untruncated weight 2.51). After combining the truncated observation weight with the 2018 cross-sectional weight, the effective sample size was approximately 2,027. The combined-weight estimates were 1.33 (95% CI 1.13 to 1.57) for Western medicine only, 1.08 (95% CI 0.83 to 1.41) for the traditional/complementary pattern, and 1.30 (95% CI 1.07 to 1.57) for integrative management (global P = 0.002; Additional file 1, Table S4).

In generalized overlap weighting, the maximum post-weighting absolute standardized mean difference was 0.076, meeting the prespecified 0.10 threshold; the median effective sample size was 1,821. Estimates from overlap weighting were OR 1.31 (95% CI 1.08 to 1.59) for Western medicine only, 1.14 (95% CI 0.87 to 1.48) for traditional/complementary modalities, and 1.28 (95% CI 1.04 to 1.57) for integrative management.

DISCUSSION

Three findings stand out. First, Western medicine use—whether alone or combined with traditional modalities—was consistently associated with greater pain severity two years later, with adjusted cumulative odds ratios around 1.3. Second, traditional and complementary approaches used without Western medicine showed no clear association with subsequent pain, a result that was broadly consistent across the prespecified sensitivity analyses we performed. Third, none of the management patterns showed clear associations with incident functional limitations, which was unexpected given the integrative group's higher baseline pain burden and comorbidity. These results were stable across several analytical choices, including explicit attrition weighting and a generalized overlap-weighting analysis with acceptable measured-covariate balance.

The central interpretation concerns utilization and prognosis rather than therapeutic effects. Participants using integrative management had more pain sites and more severe baseline pain, consistent with a pathway in which greater or more complex pain leads to more intensive and multimodal healthcare use. Even extensive regression adjustment and propensity score weighting cannot remove confounding from unmeasured pain chronicity, previous treatment response, access to care, patient preference, or clinician

selection [6]. The observed associations therefore indicate which reported use patterns mark higher subsequent pain burden, not which intervention produced that burden.

Previous CHARLS work established that Chinese medicine, Western medicine, acupuncture, and massage are commonly reported and that management choice varies by pain burden and sociodemographic factors [4]. The recent low-back-pain study also demonstrated substantial co-use of acupuncture with other modalities [5]. Our study extends that descriptive literature by leveraging a subsequent CHARLS wave and by treating the combinations as mutually exclusive management patterns. The results suggest that Western-only and integrative patterns may function as markers of a clinically complex subgroup. Clinicians encountering patients on these regimens might consider structured reassessment of pain chronicity, functional goals, and the need for multimodal coordination, rather than attributing persistent pain solely to treatment failure.

Pain and multisite pain are associated with disability in Chinese and other older populations [13, 14]. We did not find clear global differences among management patterns in incident ADL or IADL limitation. The CHARLS ADL and IADL items capture relatively severe functional impairment, and a two-year interval may have been insufficient for many participants to cross those thresholds. Limited event counts and residual selection may also have reduced sensitivity to group differences. Importantly, the null functional findings do not demonstrate that any management pattern preserved function. Evaluating functional effects requires longitudinal treatment-exposure data with dose, duration, adherence, and appropriate causal designs—information not available in CHARLS.

This study draws strength from CHARLS's national sampling frame, its prospective design (management pattern measured before outcome), the preservation of the full ordinal pain scale, and a comprehensive sensitivity-analysis suite that included attrition weighting, multiple imputation, and overlap weighting.

The limitations are substantial. The most critical is that management use and baseline pain were reported at the same 2018 interview. We have no information on when treatment started, for how long it continued, at what dose, or with what prior response. This makes confounding by indication the dominant interpretive challenge. Second, the survey did not repeat comparable management-use questions in 2020, so we cannot distinguish people who continued a treatment from those who stopped or switched—a gap that likely attenuates our estimates toward the null. Third, pain was self-reported and unlinked to clinical diagnoses, imaging, or prescription records, and reporting the same site at two waves does not demonstrate uninterrupted pain. Fourth, our analysis relies on a cross-sectional weight rather than an official CHARLS longitudinal panel weight; the stability of our results under attrition weighting is reassuring but not a complete solution. Additionally, the traditional/complementary and integrative categories combined clinically heterogeneous modalities and co-use patterns. Their estimates therefore apply to broad management-use patterns rather than individual modalities; sparse cells and multiple-comparison concerns limited reliable modality-specific modelling. Finally, the 2020 CHARLS wave coincided with the COVID-19 period, and we cannot exclude pandemic-related disruptions to healthcare access and pain-related behaviours. These limitations underscore the need for studies with richer treatment-exposure data to confirm and extend these findings. Accordingly, this study contributes evidence about reported utilization patterns and prognosis rather than the effects of individual therapies.

CONCLUSIONS

Among middle-aged and older Chinese adults with musculoskeletal pain, reported Western-medicine-only and integrative management-use patterns were associated with greater subsequent ordinal pain severity. These utilization patterns may serve as prognostic markers of a clinically complex, high-burden population warranting continued assessment and coordinated care; they do not indicate treatment benefit, harm, or comparative effectiveness.

Abbreviations

ADL

activities of daily living

CHARLS

China Health and Retirement Longitudinal Study

CES-D

Center for Epidemiologic Studies Depression Scale

CI

confidence interval

IADL

instrumental activities of daily living

OR

odds ratio

RR

risk ratio

STROBE

Strengthening the Reporting of Observational Studies in Epidemiology.

Declarations

Ethics approval and consent to participate

The original China Health and Retirement Longitudinal Study (CHARLS) protocol was approved by the Biomedical Ethics Review Committee of Peking University (IRB00001052-11015), and all participants provided informed consent. The present study was a secondary analysis of de-identified public-use human participant data and involved no direct participant contact. The Ethics Committee of the First Affiliated Hospital of Hunan University of Chinese Medicine determined that no additional ethics approval was required for this secondary analysis; therefore, no separate approval number was issued. All methods were carried out in accordance with relevant guidelines and regulations.

Clinical trial registration

Clinical trial number: not applicable. This study was an observational secondary analysis of CHARLS cohort data and did not involve the assignment of participants to any intervention.

Consent for publication

Not applicable.

Availability of data and materials

Individual-level CHARLS data are available to registered researchers through the official CHARLS data portal (<https://charls.pku.edu.cn/>), subject to the CHARLS data-use terms. The variable mappings, statistical analysis plan, aggregated results, and reproducibility code supporting this study are provided in Additional files 2 and 3. Individual-level CHARLS records are not redistributed.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was received for completion of this work.

Authors' contributions

YHZ conceived the study, developed the methodology, curated the data, performed the formal analyses, developed and validated the analysis code, prepared the tables and figures, and drafted the manuscript. SFY contributed to the study conception and methodology, supervised the study, and critically revised the manuscript. HBJ contributed to validation and interpretation of the findings and critically revised the manuscript for important intellectual content. WSO contributed to validation and interpretation of the findings and critically revised the manuscript. YY validated the statistical analyses and critically revised the manuscript. SJX contributed to data interpretation and critically revised the manuscript. LC contributed to validation and interpretation of the findings and critically revised the manuscript. ZYL contributed to interpretation of the findings and critically revised the manuscript. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Acknowledgements

The authors thank the CHARLS research team and all survey participants. This analysis used the Harmonized CHARLS dataset and codebook, Version D as of June 2021, developed by the Gateway to Global Aging Data with support from the National Institute on Aging grants R01 AG030153, RC2 AG036619, and R03 AG043052.

Authors' information

Not applicable.

References

1. Guan SY, Zheng JX, Zhang SX, Xu S, Shuai Z, Cai HY, et al. Global burden of musculoskeletal disorders in adults aged 50 and over, 1990–2021: risk factors and sociodemographic inequalities. *J Cachexia Sarcopenia Muscle*. 2025;16(4):e70008. 10.1002/jcsm.70008.
2. Zhao Y, Hu Y, Smith JP, Strauss J, Yang G. Cohort profile: the China Health and Retirement Longitudinal Study (CHARLS). *Int J Epidemiol*. 2014;43(1):61–8. 10.1093/ije/dys203.
3. Yu T, Ma J, Jiang Y, Li J, Gen Y, Wen Y, et al. Assessing pain among Chinese elderly-Chinese Health and Retirement Longitudinal Study. *Iran J Public Health*. 2018;47(4):553–60.
4. Mei F, Dong S, Li J, Xing D, Lin J. Preference of musculoskeletal pain treatment in middle-aged and elderly Chinese people: a machine learning analysis of the China Health and Retirement Longitudinal Study. *BMC Musculoskelet Disord*. 2023;24:528. 10.1186/s12891-023-06665-7.
5. Lei Y, Xia X, Huang X, Jiao Z, Bao C, Ma X. Factors associated with acupuncture treatment use among middle-aged and older adults with low back pain in China. *BMC Complement Med Ther*. 2025;25(1):343. 10.1186/s12906-025-05086-4.
6. Sendor R, Stuermer T. Core concepts in pharmacoepidemiology: confounding by indication and the role of active comparators. *Pharmacoepidemiol Drug Saf*. 2022;31(3):261–9. 10.1002/pds.5407.
7. von Elm E, Altman DG, Egger M, Pocock SJ, Goetzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Prev Med*. 2007;45(4):247–51. 10.1016/j.ypmed.2007.08.012.
8. Phillips D, Green H, Petrosyan S, Shao K, Wilkens J, Lee J, Harmonized CHARLS, Documentation, Version D. (2011–2018). Gateway to Global Aging Data; 2021. Available from: <https://charls.pku.edu.cn/en/team/Codebook.pdf>. Accessed 18 July 2026.
9. Buri M, Curt A, Steeves J, Hothorn T. Baseline-adjusted proportional odds models for the quantification of treatment effects in trials with ordinal sum score outcomes. *BMC Med Res Methodol*. 2020;20:104. 10.1186/s12874-020-00984-2.
10. White IR, Royston P, Wood AM. Multiple imputation using chained equations: issues and guidance for practice. *Stat Med*. 2011;30(4):377–99. 10.1002/sim.4067.
11. Zou G. A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004;159(7):702–6. 10.1093/aje/kwh090.
12. Li F, Morgan KL, Zaslavsky AM. Balancing covariates via propensity score weighting. *J Am Stat Assoc*. 2018;113(521):390–400. 10.1080/01621459.2016.1260466.
13. Chu J, Weng L, Jin W, Yin X, Xu Q, Xu Z. Pain status and disability in activities of daily living among older adults in China: evidence from CHARLS 2020. *Pain Res Manag*. 2025;2025:4974163. 10.1155/prm/4974163.

14. Liu P, Chen H, Tong B, Zhu D, Cong X, Shang S. Association between multisite musculoskeletal pain and disability trajectories among community-dwelling older adults. Aging Clin Exp Res. 2024;36(1):115. 10.1007/s40520-024-02764-0.

Figures

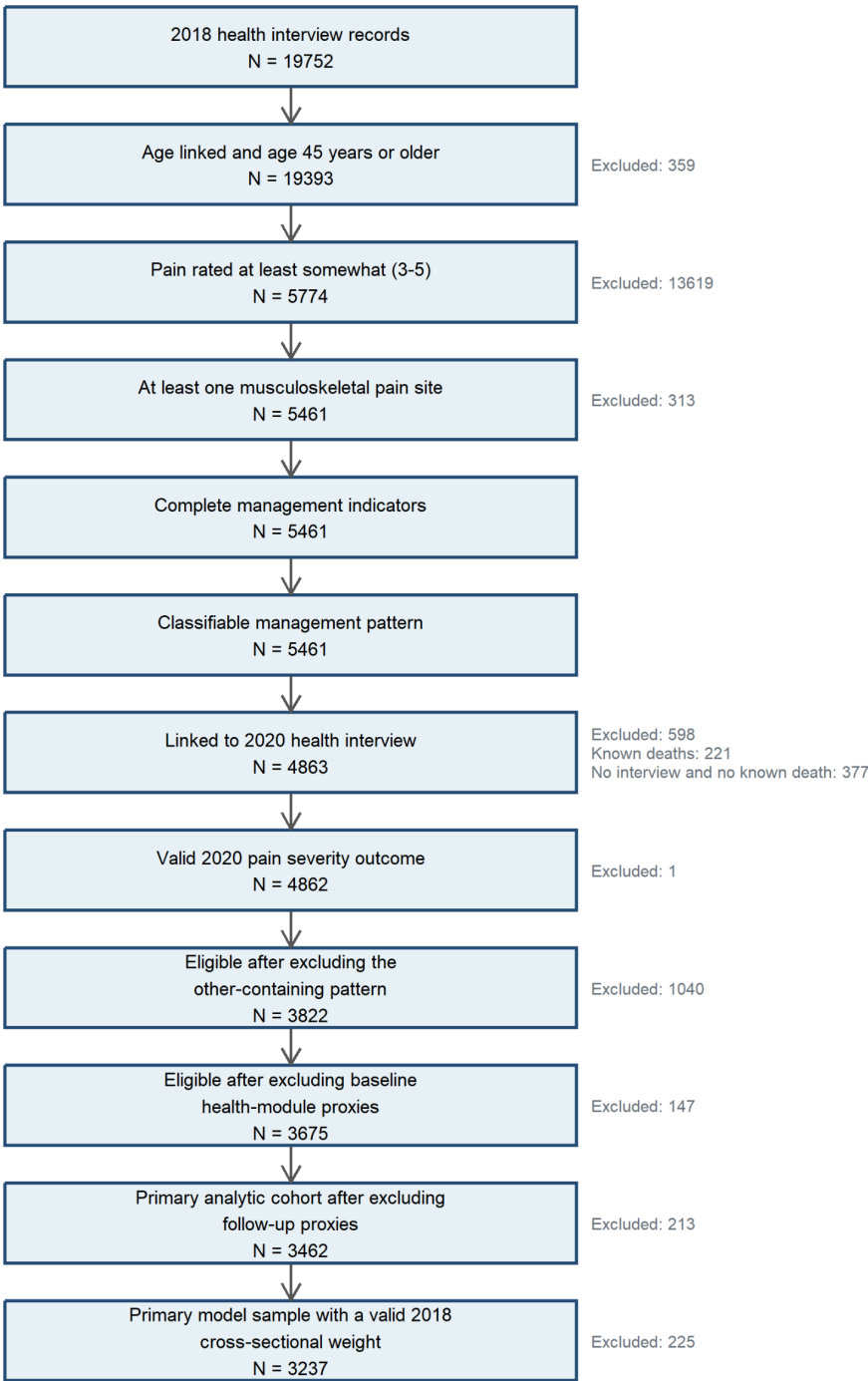


Figure 1

Construction of the primary analytic cohort. The flow diagram shows sequential eligibility, linkage, outcome, exposure, proxy-response, and survey-weight criteria from the 2018 health interview to the primary weighted model. Participants without a 2020 health interview are separated into known deaths and those without a known death record.

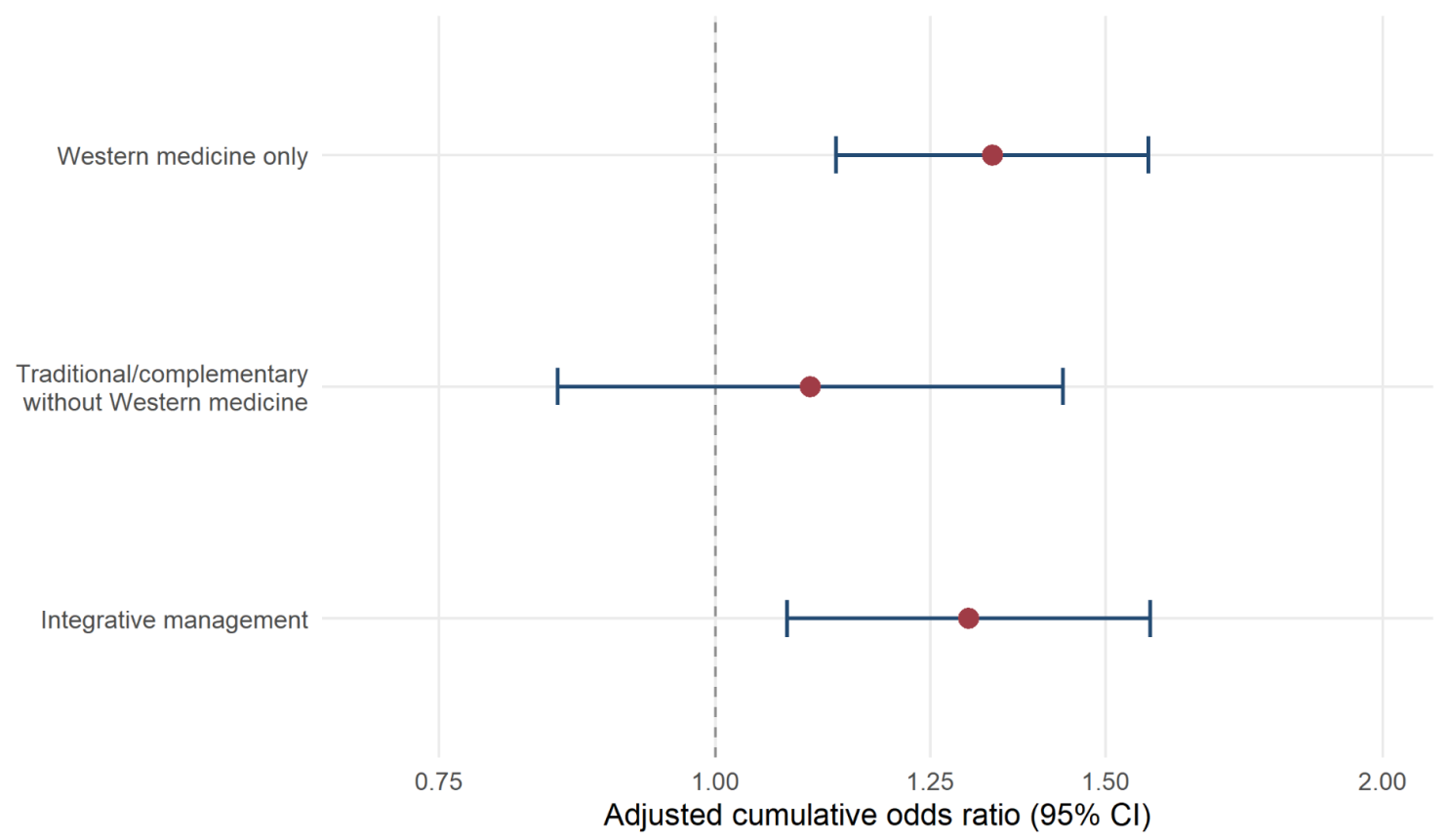


Figure 2

Reported pain-management patterns and 2020 pain severity. Points and horizontal lines show adjusted cumulative odds ratios and 95% confidence intervals from the survey-weighted proportional-odds model after multiple imputation. Reference: no reported pain-relief measure. Values above 1 indicate higher cumulative odds of being in a more severe pain category.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Additionalfile1supplement.docx](#)
- [Additionalfile2CHARLSaggregatedresults.xlsx](#)