



Association of Cardiovascular-Kidney-Metabolic Syndrome With Liver Fibrosis and Mortality in MASLD: A Systematic Review and Meta-Analysis

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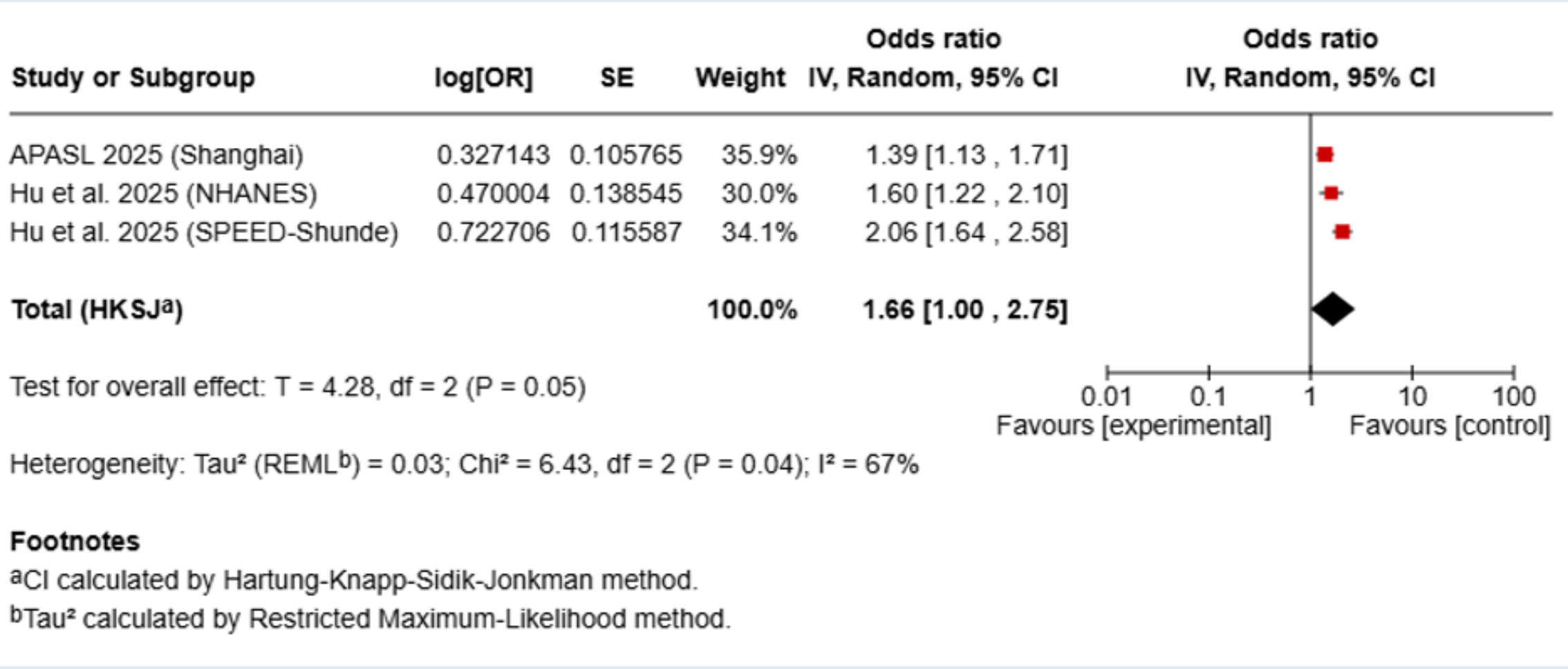
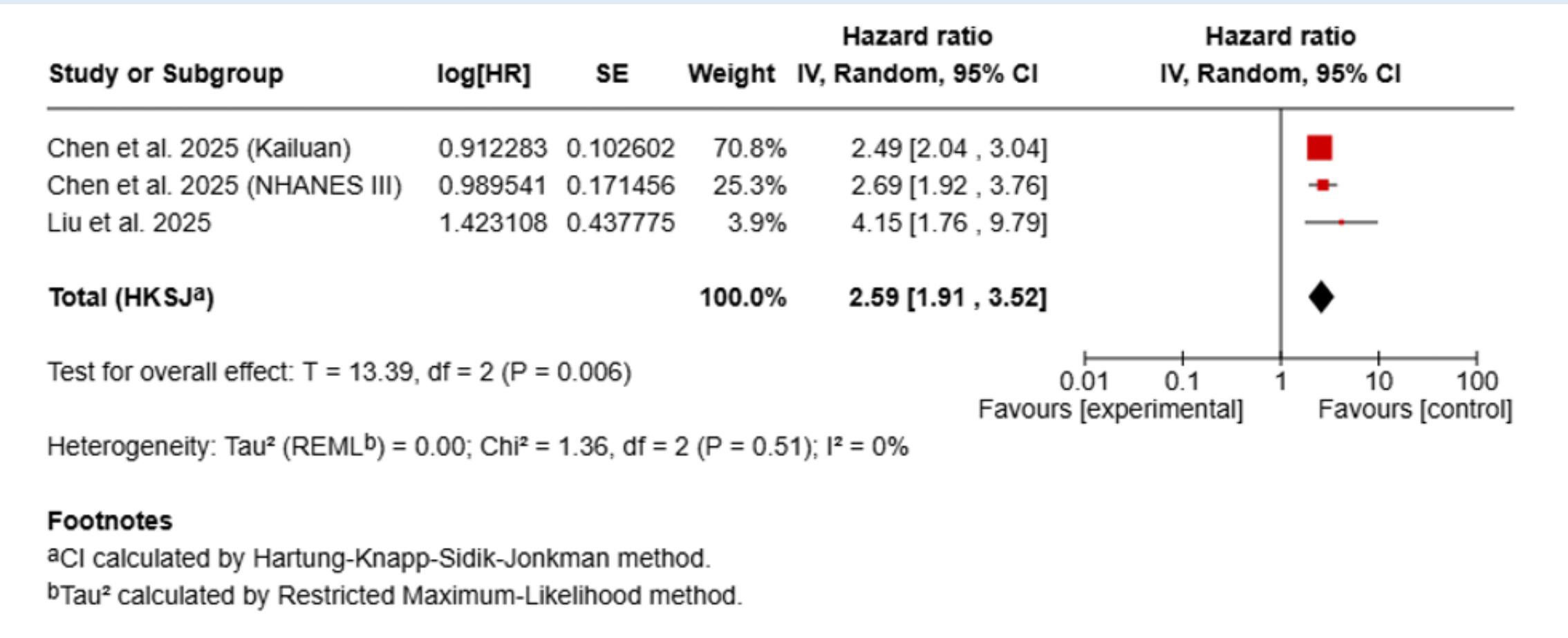
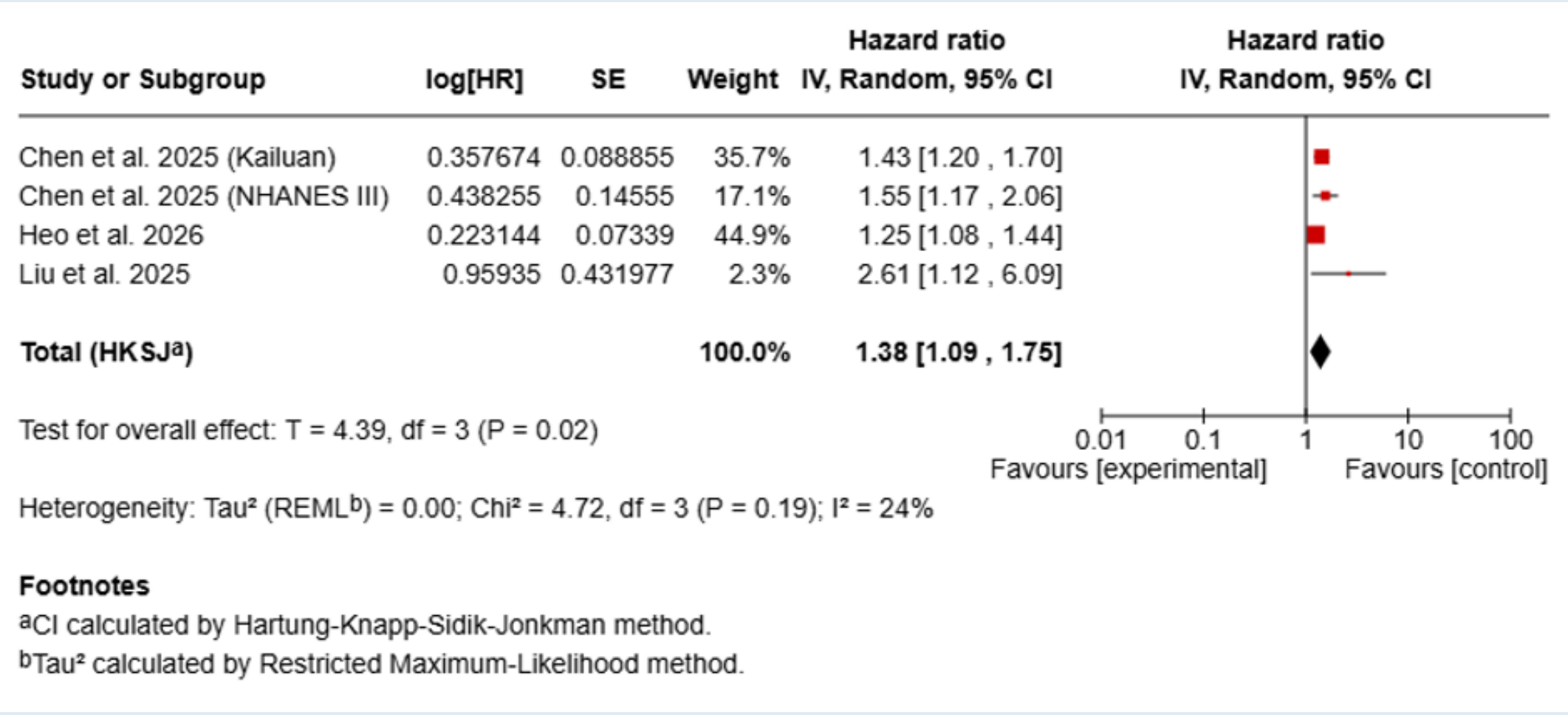
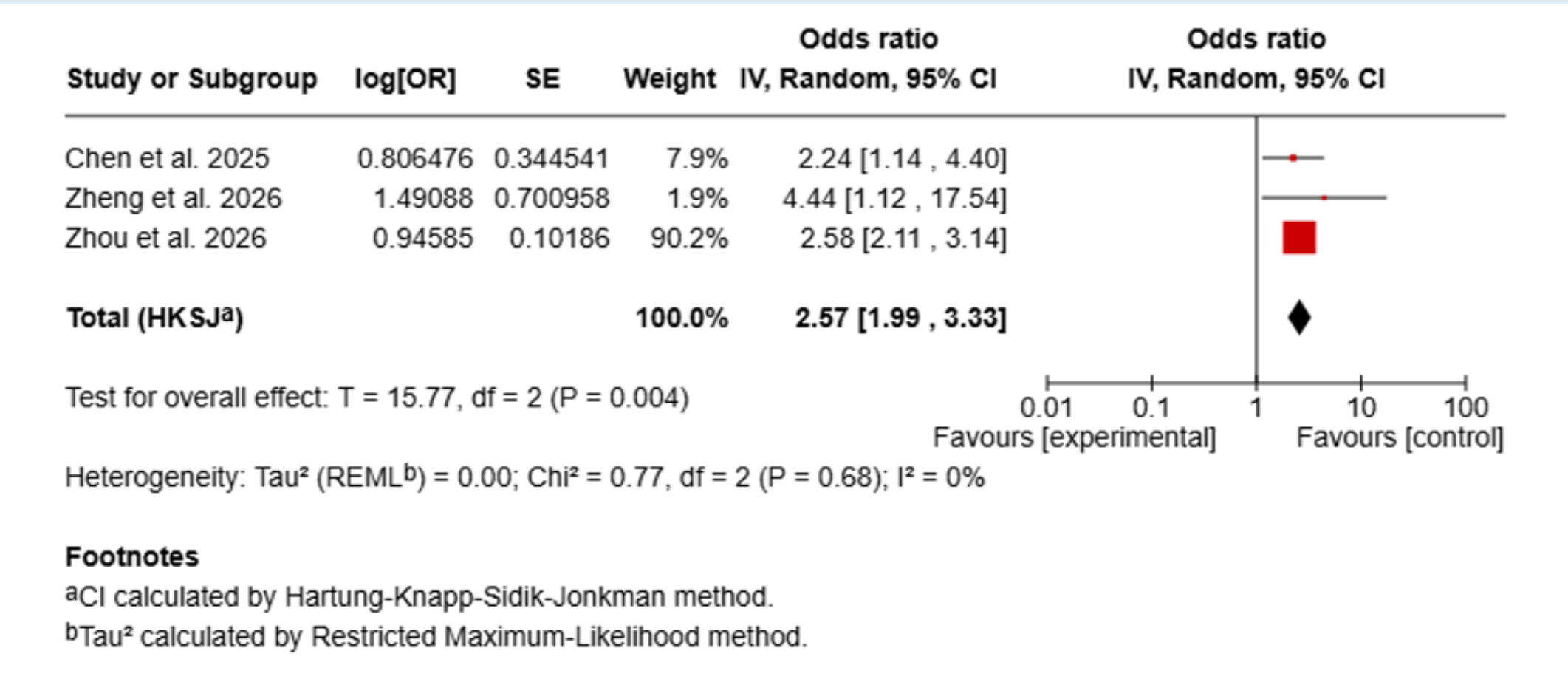
INTRODUCTION

Cardiovascular-kidney-metabolic (CKM) syndrome integrates metabolic, kidney, and cardiovascular disease within a unified clinical framework. Metabolic dysfunction-associated steatotic liver disease (MASLD) shares many metabolic pathways with CKM syndrome, but the relationship between CKM severity, liver fibrosis, and prognosis in MASLD remains incompletely defined.

METHODS

PubMed, Scopus, and Embase were searched through June 2026 for observational studies evaluating CKM stage in relation to liver fibrosis or mortality in MASLD, or MASLD in relation to CKM stages 3–4. CKM stages were defined according to American Heart Association criteria. Primary outcomes were advanced fibrosis (VCTE LSM ≥ 10 or ≥ 11.6 kPa) and clinically significant fibrosis (advanced fibrosis or FIB-4 ≥ 1.3). Secondary outcomes included all-cause, cardiovascular, and liver-related mortality. Adjusted estimates were pooled using random-effects models. Study quality was assessed using the Newcastle-Ottawa Scale.

RESULTS



CONCLUSION

Across 8 studies, 10 cohorts, and 1,089,837 participants, advanced CKM stages were associated with clinically significant liver fibrosis and higher all-cause and cardiovascular mortality in patients with MASLD. MASLD was also associated with CKM stages 3–4, although more modestly. CKM staging may help identify patients with MASLD at increased risk of fibrosis and adverse outcomes.

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