SUPPLEMENTARY INFORMATION

Transcatheter tricuspid valve intervention (TTVI) plus optimized medical therapy (OMT) versus optimized medical therapy (OMT) alone in tricuspid regurgitation: a systematic review and meta-analysis

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Supplementary Figure 6: leave-one-out analysis of primary outcomes.

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Supplementary Table 1: Search Strategy.

Database	Search Strategy
PubMed	("Transcatheter Tricuspid" OR "Edge-to-edge repair" OR "Tricuspid Repair" OR "Tricuspid Replacement" OR "Tricuspid Implantation" OR "Tricuspid Intervention" OR TriClip OR PASCAL OR FORMA OR Trialign OR TriCinch OR Cardioband OR TRAIPTA OR K-Clip OR Navigate OR EVOQUE OR LuX-Valve OR Cardiovalve OR "PTVR" OR "PTVI" OR TTVR OR "TEER") AND ("Tricuspid Valve Insufficiency" OR "Tricuspid Valve Regurgitation" OR "Tricuspid Valve" OR "Tricuspid Valve Incompetence" OR "Tricuspid Incompetence" OR "Tricuspid Regurgitation" OR "Atrioventricular Valve Insufficiency" OR "Right Atrioventricular Valve Regurgitation" OR "Tricuspid Valvular Insufficiency" OR "Tricuspid Valvular Regurgitation" OR "Tricuspid Insufficiency" OR "Tricuspidal Insufficiency" OR tricuspid valve replacement) AND ("Medical therapy" OR "Medical therapies" OR "Medical treatment" OR "Medical treatments" OR Medication OR Medications OR "Drug therapy" OR "Drug Therapies" OR Pharmacotherapy OR Pharmacotherapies OR "Conservative Treatment" OR "Conservative Treatments" OR "Conservative Management" OR "Conservative Managements" OR "Conservative Therapy" OR "Conservative Therapies" OR "non-surgical treatment")
Scopus	ALL (("Transcatheter Tricuspid" OR "Edge-to-edge repair" OR "Tricuspid Repair" OR "Tricuspid Replacement" OR "Tricuspid Implantation" OR "Tricuspid Intervention" OR TriClip OR PASCAL OR FORMA OR Trialign OR TriCinch OR Cardioband OR TRAIPTA OR K-Clip OR Navigate OR EVOQUE OR LuX-Valve OR Cardiovalve OR "PTVR" OR "PTVI" OR TTVR OR "TEER") AND ("Tricuspid Valve Insufficiency" OR "Tricuspid Valve Regurgitation" OR "Tricuspid Valve" OR "Tricuspid Valve Incompetence" OR "Tricuspid Incompetence" OR "Tricuspid Regurgitation" OR "Atrioventricular Valve Insufficiency" OR "Right Atrioventricular Valve Regurgitation" OR "Tricuspid Valvular Insufficiency" OR "Tricuspid Valvular Regurgitation" OR "Tricuspid Insufficiency" OR "Tricuspidal Insufficiency" OR tricuspid valve replacement) AND ("Medical therapy" OR "Medical therapies" OR "Medical treatment" OR "Medical treatments" OR Medication OR Medications OR "Drug therapy" OR "Drug Therapies" OR Pharmacotherapy OR Pharmacotherapies OR "Conservative Treatment" OR "Conservative Treatments" OR "Conservative Management" OR "Conservative Managements" OR "Conservative Therapy" OR "Conservative Therapies" OR "non-surgical treatment"))
Web of Science	("Transcatheter Tricuspid" OR "Edge-to-edge repair" OR "Tricuspid Repair" OR "Tricuspid Replacement" OR "Tricuspid Implantation" OR "Tricuspid Intervention" OR TriClip OR PASCAL OR FORMA OR Trialign OR TriCinch OR Cardioband OR TRAIPTA OR K-Clip OR Navigate OR EVOQUE OR LuX-Valve OR Cardiovalve OR "PTVR" OR "PTVI" OR TTVR OR "TEER") AND ("Tricuspid Valve Insufficiency" OR "Tricuspid Valve Regurgitation" OR "Tricuspid Valve" OR "Tricuspid Valve Incompetence" OR "Tricuspid Incompetence" OR "Tricuspid Regurgitation" OR "Atrioventricular Valve Insufficiency" OR "Right Atrioventricular Valve Regurgitation" OR "Tricuspid Valvular Insufficiency" OR "Tricuspid Valvular Regurgitation" OR "Tricuspid Insufficiency" OR "Tricuspidal Insufficiency" OR tricuspid valve replacement) AND ("Medical therapy" OR "Medical therapies" OR "Medical treatment" OR "Medical treatments" OR Medication OR Medications OR "Drug therapy" OR "Drug Therapies" OR Pharmacotherapy OR Pharmacotherapies OR "Conservative Treatment" OR "Conservative Treatments" OR "Conservative Management" OR "Conservative Managements" OR "Conservative Therapy" OR "Conservative Therapies" OR "non-surgical treatment")

Supplementary Table 2: Excluded Full-Text Studies and Reasons for Exclusion

Study	DOI	Reason for Exclusion

Orban M. et al. 2018	10.1002/ejhf.1147	No OMT comparator
Lee et al. 2021	10.1016/j.athoracsur.2020.09.028	Pilot feasibility; single-arm; no comparative OMT group
Ning et al. 2021	10.3760/cma.j.cn112148-20210125-00091	Small single-center feasibility; no OMT comparator
Meijerink F. et al. 2021	10.1007/s12471-021-01613-3	Registry experience; no OMT comparator
Hahn et al. 2025	10.1056/nejmoa2401918	TRISCEND II (old) less follow-up period
Sorajja et al. 2023	10.1056/nejmoa2300525	TRILUMINATE Pivotal (old) less fellow-up period
Kodali et al. 2023	10.1016/j.jacc.2023.02.049	Early feasibility; single-arm
Kitamura et al. 2021	10.1016/j.jcin.2021.09.021	No OMT comparator

Supplementary Table 3: Comparative Registries and Studies Screened but Excluded

Study/Registry	Year	Device(s)	Comparator	Reason for Exclusion
EuroTR Registry	2023	TriClip, PASCAL	None	Single-arm design; no OMT comparator
TriValve Registry	2022	Mixed devices	None	Descriptive outcomes only; no hazard ratios or time-to-event data
TRILUMINATE single-arm study	2019	TriClip	None	single-arm design
TRISCEND I	2021	EVOQUE	None	Feasibility study; no OMT control group
LuX-Valve Pilot Studies	2020-2022	LuX-Valve	None	Small single-arm feasibility cohorts
Other device-specific registries (e.g., PASCAL early experience)	Various	Various	None	Noncomparative; insufficient outcome reporting

Supplementary Table 4: Baseline data scores.

Study ID	Euro Score II		NYHA III to IV		STS mortalitay Score		KCCQ-OS Score	
	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT
Wang 2024	N/A	N/A	31 (100%)	46 (80.7%)	11.0 (±2.0)	10.2 (±1.0)	34.74 (±7.4)	45.0 (±5.2)
Arnold 2025 TRISCEND	N/A	N/A	N/A	N/A	N/A	N/A	52.8 (±22.0)	50.6 (±21.4)
Tang 2025	N/A	N/A	160 (56.1%)	155 (54.0%)	N/A	N/A	55.6 (±22.9)	54.6 (±23.8)
Taramasso 2019	12 (±11)	13 (±9)	249.24 (93%)	61.64 (23%)	N/A	N/A	N/A	N/A
Donal 2024	N/A	N/A	59 (38.9%)	68 (45.9%)	N/A	N/A	54.0 (±23.4)	54.0 (±25.0)
Scotti 2022	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cai 2020	N/A	N/A	43 (81.1%)	48 (67.6%)	N/A	N/A	N/A	N/A

Kresoja 2020	5.07 (±3.16)	5.03 (±4.14)	80 (85.1%)	66 (70.2%)	N/A	N/A	N/A	N/A

Supplementary Table 5: Baseline data LAB.

Study ID	NT-proBNP (pg/L)		Alanine transaminase (U/L)		Aspartate transaminase (U/L)		eGFR (mL/min/1.73m2)		Creatinine (mmol/L)	
	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT
Wang 2024	1265.4 (±608.7)	923.8 (±81.4)	21.2 (±6.2)	24.0 (±3.2)	30.0 (±7.6)	22.9 (±4.4)	56.82 (±11.9)	66.0 (±7.3)	124.50 (±22.6)	121.2 (±23.4)
Arnold 2025	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tang 2025	1871100 (±1483900)	2420700 (±3416100)	N/A	N/A	N/A	N/A	55.6 (±21.1)	57.8 (±20.8)	N/A	N/A
Taramasso 2019	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Donal 2024	N/A	N/A	N/A	N/A	N/A	N/A	13 (±8.55)	6 (±4.05)	N/A	N/A
Scotti 2022	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cai 2020	3598.0 (±984.4)	939.6 (±278.8)	19.4 (±8.9)	22.3 (±18.3)	25.5 (±8.9)	30.7 (±17.6)	44.5 (±18.0)	54.1 (±24.5)	127.6 (±48.0)	125.6 (±67.4)
Kresoja 2020	5372 (±9021)	5819 (±8706)	N/A	N/A	N/A	N/A	47.33 (±24.09)	48.33 (±24.85)	1.37 (±0.45)	1.37 (±0.6)

Supplementary Table 6: Baseline data Echo.

Study ID	TAPSE (mm)		LVEF (%)		SPAP, systolic pulmonary artery pressure		LVESD (mm)		LVEDD (mm)		TR severity n (%)		RV end diastolic diameter mid (mm)	
	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT	TTVI+OMT	OMT
Wang 2024	14.3 (±2)	16.2 (±2.1)	53.9 (±3)	55.8 (±4.3)	45.3 (±2.8)	45.0 (±3.9)	34.5 (±9.3)	35.1 (±4.3)	47.4 (±9.1)	43 (±3.4)	31 (100%)	57 (100%)	44.2 (±5)	38 (±4.7)
Arnold 2025	N/A	N/A	54.4 (±9.9)	54.3 (±11.1)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tang 2025	17 (±4)	16 (±4)	59.4 (±9.0)	59.7 (±9.2)	39.1 (±9.4)	39.8 (±9.6)	N/A	N/A	N/A	N/A	N/A	N/A	37 (±	37 (±8)

													7)	
Taramasso 2019	N/A	N/A	49 (±15)	50 (±15)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Donal 2024	N/A	N/A	N/A	N/A	22.2 (±6.4)	22.6 (±6.7)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Scotti 2022	16.6 (±4.9)	17.6 (±5.5)	50.6 (±13.5)	50.4 (±18.2)	N/A	N/A	N/A	N/A	27.3 (±5.0)	25.7 (±5.2)	N/A	N/A	N/A	N/A
Cai 2020	15.6 (±3.4)	16.3 (±4.5)	49.7 (±16.6)	51.4 (±13.2)	N/A	N/A	35 (±10)	32 (±10)	49 (±10)	46 (±8)	53 (100%)	71 (100%)	N/A	N/A
Kresoja 2020	16.4 (±5.2)	17.3 (±4.8)	51.6 (±14.3)	51.4 (±14.2)	N/A	N/A	N/A	N/A	N/A	N/A	57 (60.6%)	58 (61.7%)	43.8 (±7.4)	39.9 (± 9.4)

Supplementary Table 7: shows the risk of bias assessment of randomized trials using the ROB-2 tool.

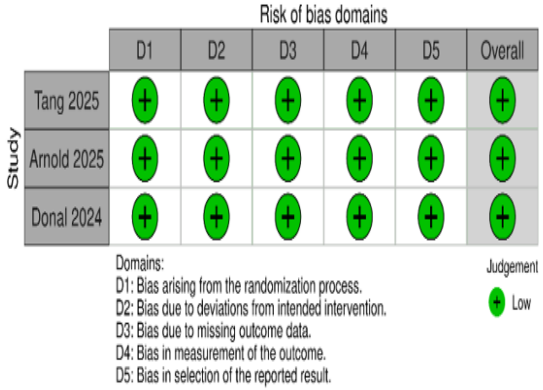
Study ID	D1	D2	D3	D4	D5	Overall risk of bias
Tang 2025	Low	Low	Low	Low	Low	Low risk of bias
Arnold 2025	Low	Low	Low	Low	Low	Low risk of bias
Donal 2024	Low	Low	Low	Low	Low	Low risk of bias

Supplementary Table 8: shows the risk of bias assessment of non-randomized studies using the ROBINS I tool.

Study ID	D1	D2	D3	D4	D5	D6	D7	Overall risk of bias

Wang 2024	Serious	Low	Low	Low	Low	Low	Low	Serious risk of bias
Andrea Scotti 2023	Serious	Moderate	Low	Low	Low	Moderate	Low	Moderate risk of bias
Cai 2020	Serious	Serious	Low	Serious	Low	Serious	Serious	Serious risk of bias
Kresoja 2020	Moderate	Low	Low	Low	Low	Low	Low	Moderate risk of bias
Taramasso 2019	Serious	Low	Low	Low	Low	Serious	Serious	Serious risk of bias

A



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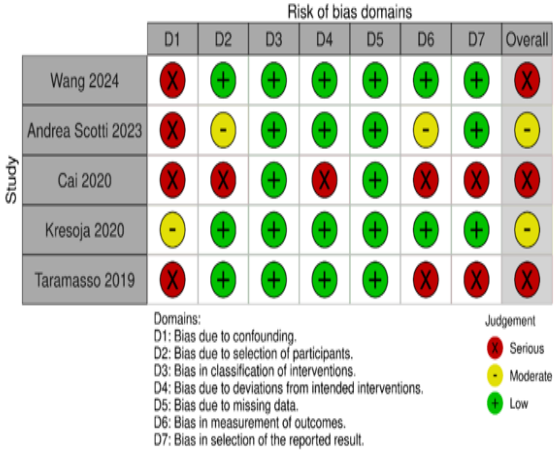
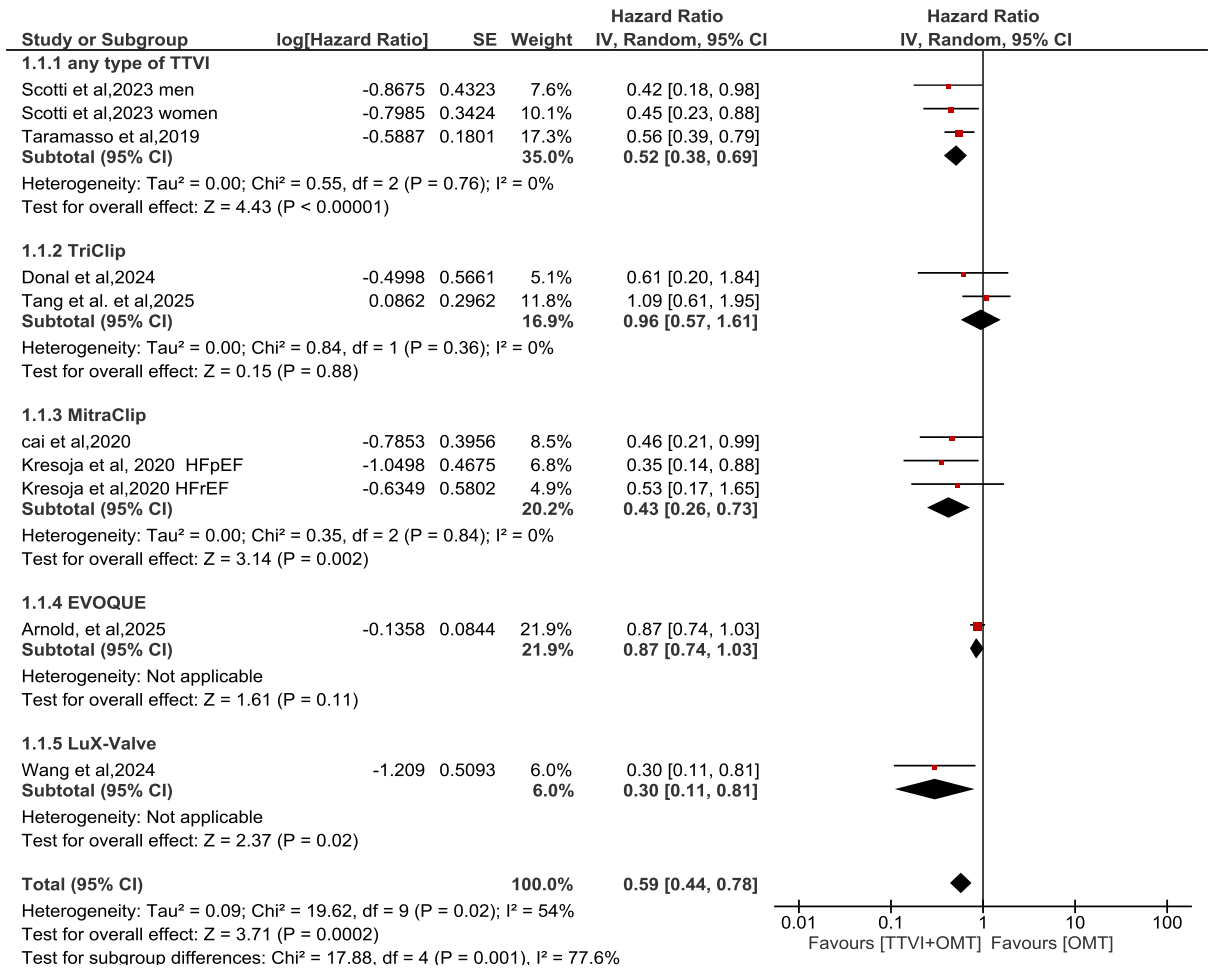
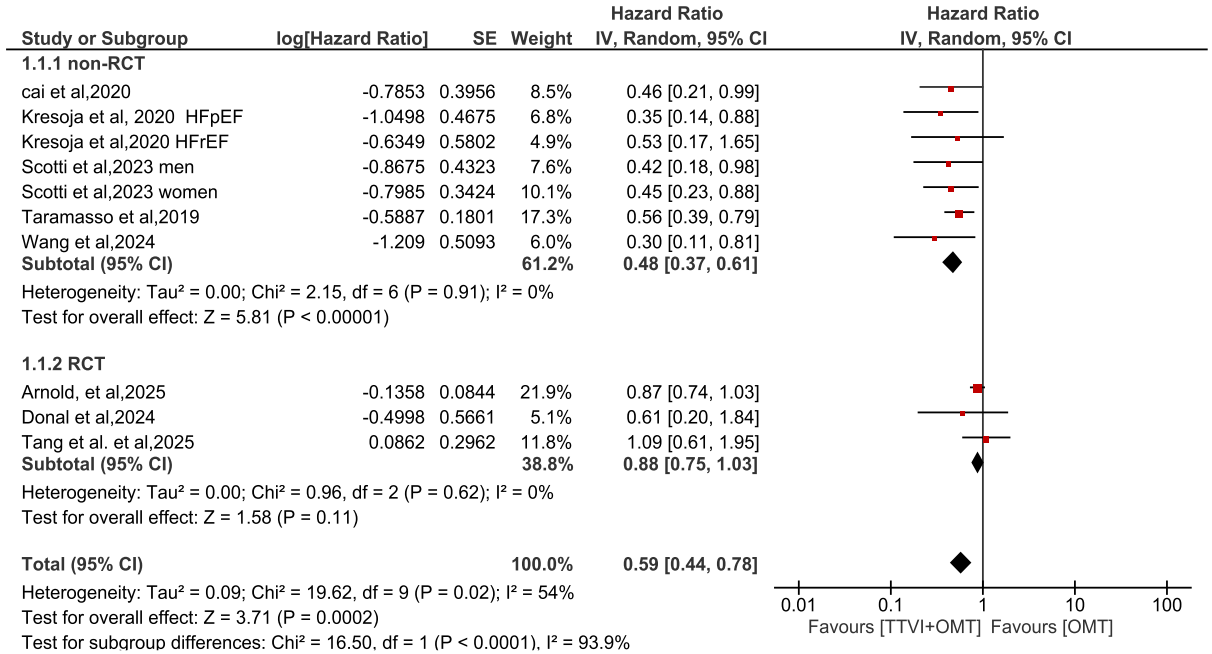


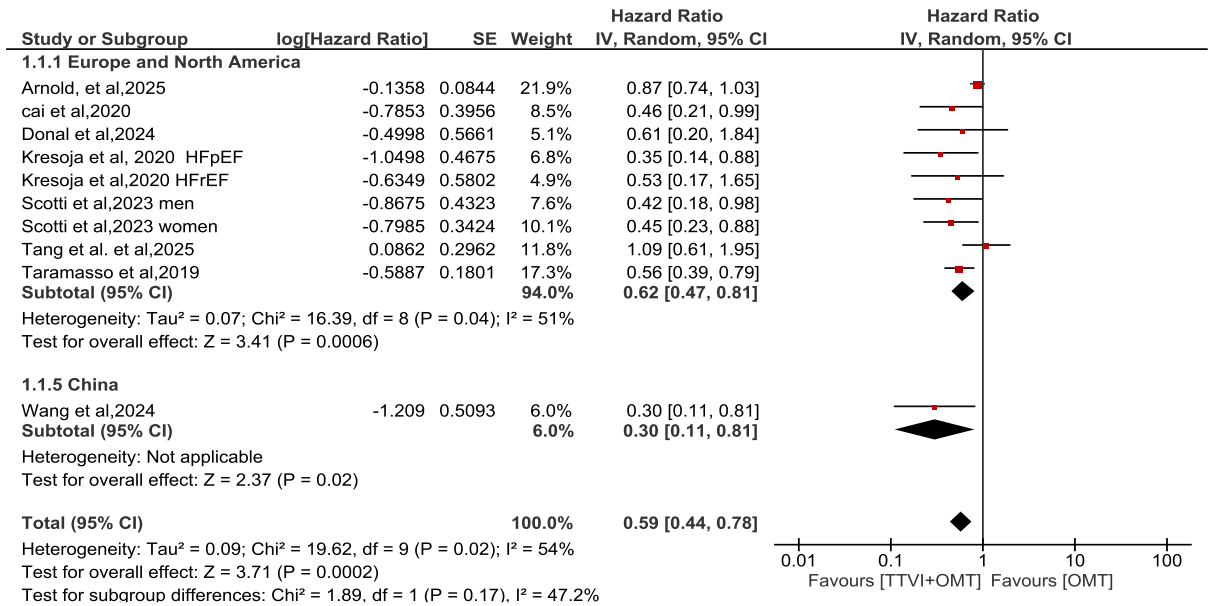
Supplementary Figure 1: (A) shows the risk of bias summary of randomized trials using the ROB-2 tool, (B) shows the risk of bias summary of non-randomized studies using the ROBINS I tool.



Supplementary Figure 2: Forest plot for Subgroup analysis of type of TTVI of hazard ratio of all-cause mortality comparing TTRI+OMT with OMT alone.

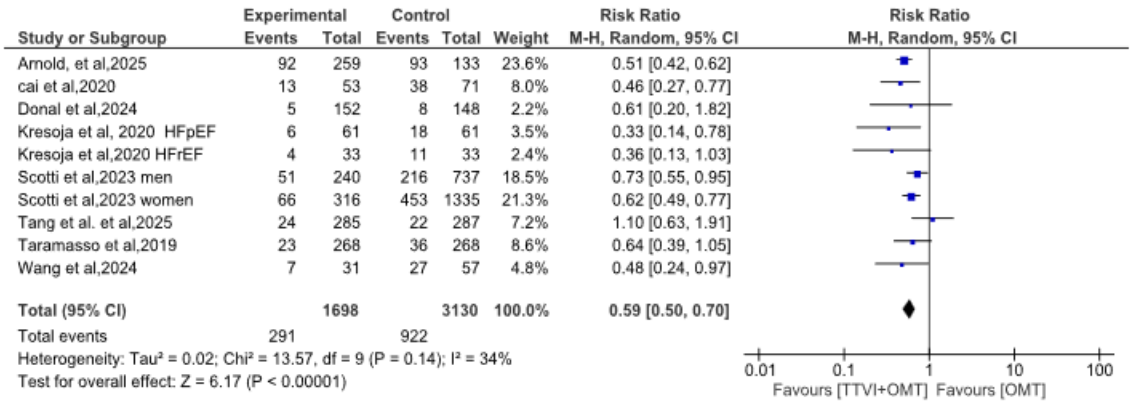


Supplementary Figure 3: Forest plot for Subgroup analysis of study designs of hazard ratio of all-cause mortality comparing TTRI+OMT with OMT alone.

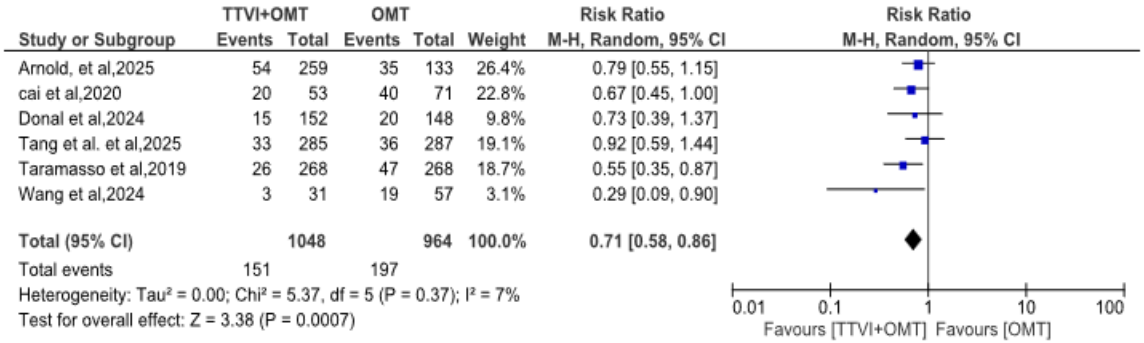


Supplementary Figure 4: Forest plot for Subgroup analysis according to geographical area of hazard ratio of all-cause mortality comparing TTRI+OMT with OMT alone

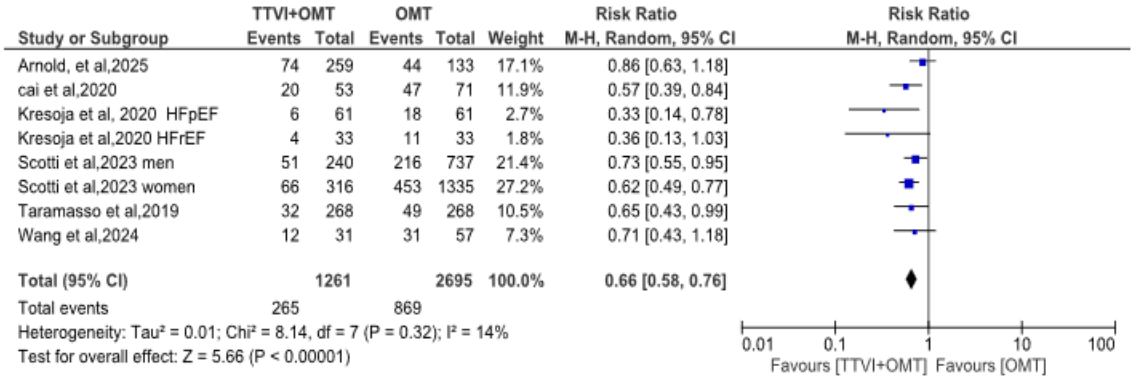
A


Experimental
Control
Risk Ratio
Risk Ratio
Study or Subgroup
Events Total Events Total Weight
M-H, Random, 95% CI
M-H, Random, 95% CI
Arnold, et al,2025 92 259 93 133 23.6% 0.51 [0.42, 0.62]
cai et al,2020 13 53 38 71 8.0% 0.46 [0.27, 0.77]
Donal et al,2024 5 152 8 148 2.2% 0.61 [0.20, 1.82]
Kresoja et al, 2020 HFpEF 6 61 18 61 3.5% 0.33 [0.14, 0.78]
Kresoja et al,2020 HFrEF 4 33 11 33 2.4% 0.36 [0.13, 1.03]
Scotti et al,2023 men 51 240 216 737 18.5% 0.73 [0.55, 0.95]
Scotti et al,2023 women 66 316 453 1335 21.3% 0.62 [0.49, 0.77]
Tang et al. et al,2025 24 285 22 287 7.2% 1.10 [0.63, 1.91]
Taramasso et al,2019 23 268 36 268 8.6% 0.64 [0.39, 1.05]
Wang et al,2024 7 31 27 57 4.8% 0.48 [0.24, 0.97]
Total (95% CI) 1698 3130 100.0% 0.59 [0.50, 0.70]
Total events 291 922
Heterogeneity: Tau² = 0.02; Chi² = 13.57, df = 9 (P = 0.14); I² = 34%
Test for overall effect: Z = 6.17 (P < 0.00001)
0.01 0.1 1 10 100
Favours [TTVI+OMT] Favours [OMT]

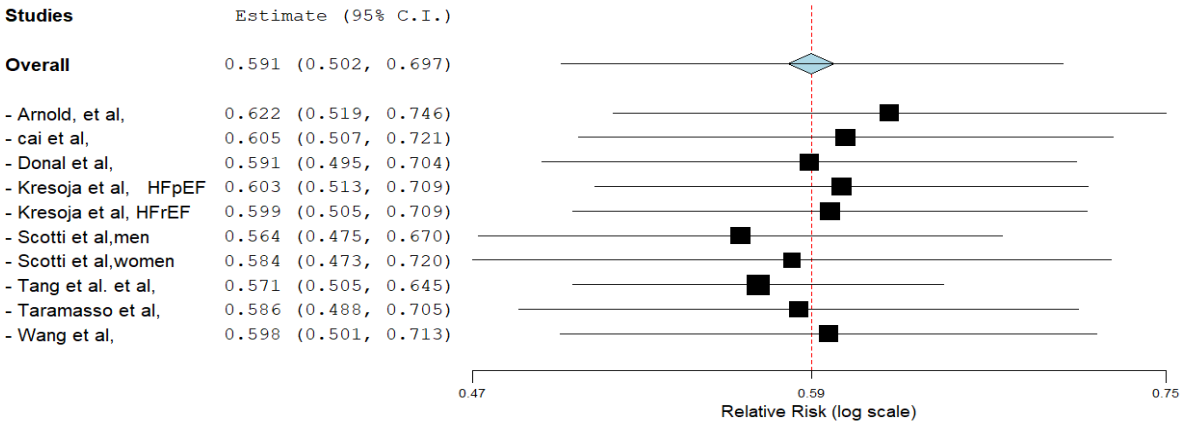
B


TTVI+OMT
OMT
Risk Ratio
Risk Ratio
Study or Subgroup
Events Total Events Total Weight
M-H, Random, 95% CI
M-H, Random, 95% CI
Arnold, et al,2025 54 259 35 133 26.4% 0.79 [0.55, 1.15]
cai et al,2020 20 53 40 71 22.8% 0.67 [0.45, 1.00]
Donal et al,2024 15 152 20 148 9.8% 0.73 [0.39, 1.37]
Tang et al. et al,2025 33 285 36 287 19.1% 0.92 [0.59, 1.44]
Taramasso et al,2019 26 268 47 268 18.7% 0.55 [0.35, 0.87]
Wang et al,2024 3 31 19 57 3.1% 0.29 [0.09, 0.90]
Total (95% CI) 1048 964 100.0% 0.71 [0.58, 0.86]
Total events 151 197
Heterogeneity: Tau² = 0.00; Chi² = 5.37, df = 5 (P = 0.37); I² = 7%
Test for overall effect: Z = 3.38 (P = 0.0007)
0.01 0.1 1 10 100
Favours [TTVI+OMT] Favours [OMT]

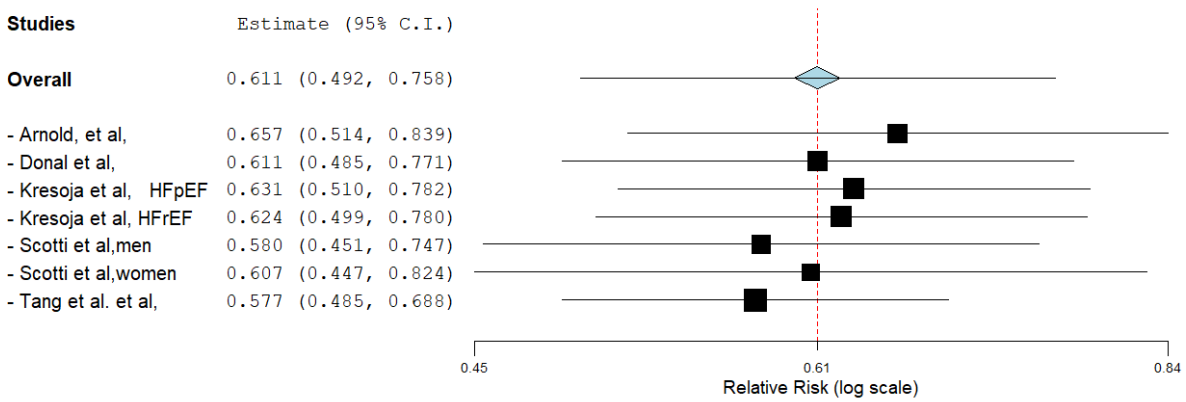
C


TTVI+OMT
OMT
Risk Ratio
Risk Ratio
Study or Subgroup
Events Total Events Total Weight
M-H, Random, 95% CI
M-H, Random, 95% CI
Arnold, et al,2025 74 259 44 133 17.1% 0.86 [0.63, 1.18]
cai et al,2020 20 53 47 71 11.9% 0.57 [0.39, 0.84]
Kresoja et al, 2020 HFpEF 6 61 18 61 2.7% 0.33 [0.14, 0.78]
Kresoja et al,2020 HFrEF 4 33 11 33 1.8% 0.36 [0.13, 1.03]
Scotti et al,2023 men 51 240 216 737 21.4% 0.73 [0.55, 0.95]
Scotti et al,2023 women 66 316 453 1335 27.2% 0.62 [0.49, 0.77]
Taramasso et al,2019 32 268 49 268 10.5% 0.65 [0.43, 0.99]
Wang et al,2024 12 31 31 57 7.3% 0.71 [0.43, 1.18]
Total (95% CI) 1261 2695 100.0% 0.66 [0.58, 0.76]
Total events 265 869
Heterogeneity: Tau² = 0.01; Chi² = 8.14, df = 7 (P = 0.32); I² = 14%
Test for overall effect: Z = 5.66 (P < 0.00001)
0.01 0.1 1 10 100
Favours [TTVI+OMT] Favours [OMT]

Supplementary Figure 5: (A) Forest plot of risk ratio of all-cause mortality comparing TTRI+OMT with OMT alone, (B) Forest plot of risk ratio of HF hospitalization comparing TTRI+OMT with OMT alone, (C) Forest plot of risk ratio of combined outcome comparing TTRI+OMT with OMT alone



Supplementary Figure 6: leave-one-out analysis of primary outcomes.



Supplementary Figure 7: leave-one-out analysis of primary outcomes after excluding high-risk bias studies.