

Supplementary Appendix 1: Complete Database Search Strategies

Manuscript No. 123559 — World Journal of Cardiology

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Database	Search Date	Records Retrieved	Search String	Vocabulary Type	Filters / Limits Applied
PubMed/ MEDLINE	February 19, 2026	176	("Transcatheter Aortic Valve Replacement"[Mesh] OR "Transcatheter Aortic Valve Implantation"[tiab] OR "TAVR"[tiab] OR "TAVI"[tiab] OR "transcatheter aortic valve"[tiab]) AND ("Cardiac Conduction System Disease"[Mesh] OR "Bundle-Branch Block"[Mesh] OR "Atrioventricular Block"[Mesh] OR conduction abnormalit*[tiab] OR conduction disorder*[tiab] OR conduction disease*[tiab] OR "bundle branch block"[tiab] OR RBBB[tiab] OR LBBB[tiab] OR "right bundle branch block"[tiab] OR "left bundle branch block"[tiab] OR "AV block"[tiab] OR "atrioventricular block"[tiab] OR "first degree AV block"[tiab] OR bifascicular[tiab] OR ECG[tiab] OR electrocardiogra*[tiab]) AND ("Pacemaker, Artificial"[Mesh] OR pacemaker*[tiab] OR "permanent pacemaker"[tiab] OR "pacemaker implantation"[tiab] OR PPI[tiab]) AND ("2010/01/01"[Date - Publication] : "2026/02/19"[Date - Publication]) AND English[lang] AND Humans[Mesh]	MeSH (Medical Subject Headings) + free-text [tiab] fields	Language: English Species: Humans Date: 2010/01/01 – 2026/02/19 Article type filters (PubMed sidebar): • Clinical Study • Clinical Trial • Multicenter Study • Observational Study • Randomized Controlled Trial
Embase	February 19, 2026	58 (#1 combined with #2)	<u>Search String #1:</u> ('transcatheter aortic valve implantation'/exp OR 'transcatheter aortic valve replacement':ti,ab OR 'transcatheter aortic valve implantation':ti,ab OR tavr:ti,ab OR tavi:ti,ab OR 'transcatheter aortic valve':ti,ab) AND ('heart conduction disturbance'/exp OR 'bundle branch block'/exp OR 'atrioventricular block'/exp OR 'conduction abnormalit*':ti,ab OR 'conduction disorder*':ti,ab OR 'conduction disease*':ti,ab OR 'bundle branch block':ti,ab)	Emtree subject headings: /exp = exploded /de = subject heading /it = index term + free-text :ti,ab fields	Language: English [english]/lim Species: Humans [humans]/lim Date: [2010-2026]/py Study type filters (Embase /de terms): • case report • clinical trial • cohort analysis • comparative study • controlled study

Database	Search Date	Records Retrieved	Search String	Vocabulary Type	Filters / Limits Applied
			OR rbbb:ti,ab OR lbbb:ti,ab OR 'right bundle branch block':ti,ab OR 'left bundle branch block':ti,ab OR 'av block':ti,ab OR 'atrioventricular block':ti,ab OR 'first degree av block':ti,ab OR bifascicular:ti,ab OR ecg:ti,ab OR electrocardiogra*:ti,ab) AND ('artificial heart pacemaker'/exp OR pacemaker*:ti,ab OR 'permanent pacemaker':ti,ab OR 'pacemaker implantation':ti,ab OR ppi:ti,ab) AND [english]/lim AND [humans]/lim AND [2010-2026]/py <u>Search String #2 (combined with #1):</u> #1 AND ('case report'/de OR 'clinical trial'/de OR 'cohort analysis'/de OR 'comparative study'/de OR 'controlled study'/de OR 'human'/de OR 'multicenter study'/de OR 'observational study'/de OR 'prospective study'/de OR 'retrospective study'/de) AND 'clinical trial'/it		• multicenter study • observational study • prospective study • retrospective study • clinical trial /it
Cochrane CENTRAL	February 19, 2026	128	(transcatheter aortic valve implantation OR transcatheter aortic valve replacement OR TAVR OR TAVI OR "transcatheter aortic valve" OR Evolut OR CoreValve) AND (bundle branch block OR RBBB OR LBBB OR "right bundle branch block" OR "left bundle branch block" OR "AV block" OR atrioventricular block OR conduction) AND (pacemaker* OR "permanent pacemaker" OR "pacemaker implantation" OR pacing)	Cochrane subject headings + free-text Title/Abstract/Keyword fields	No additional filters applied (Cochrane CENTRAL is inherently limited to controlled trials and clinical study designs)
Total (before deduplication)		362	43 duplicates removed; 14 ineligible by automation tools; 29 removed for other reasons → 276 records proceeded to title/abstract screening		

Note:

Manual reference list screening of all 20 included studies was performed to identify eligible reports not captured by the electronic database searches. No grey literature sources, trial registries, or citation-tracking databases were searched beyond the three primary databases. Equivalent structured vocabulary was used across all databases. MeSH = Medical Subject Headings; Emtree = Elsevier Life Sciences Thesaurus; CENTRAL = Cochrane Central Register of Controlled Trials; tiab = title/abstract field tag; ti,ab = title/abstract field code; /exp = exploded Emtree term; /de = Emtree subject heading; /lim = limit; /py = publication year; /it = index term.

Supplementary Appendix 2: R Analysis and Figure Generation Script

The following R script was used to perform all meta-analyses and generate all figures for this manuscript. Figures 1 (PRISMA 2009 flow diagram) and 2 (risk of bias plots) were generated using external online tools (prisma.thetacollaborative.ca and robvis.net, respectively) and are not produced by this script.

Main text figures generated by this script (Figures 3-6):

- Figure 3: Pooled PPI incidence forest plot (20 studies, n=15,104, generalized linear mixed model on the logit scale)
- Figure 4: Valve-type subgroup analysis, PPI incidence
- Figure 5: New-onset LBBB forest plot (11 studies, n=4,907)
- Figure 6: Updated forest plot, RBBB → PPI (4 studies, OR 4.52, REML)

Supplementary figures generated by this script (Supplementary Figures 1-8):

- WITHDRAWN: the original 6-study forest plot (OR 5.26, common effect) is no longer generated or presented, following source verification of its two-by-two counts.
- Supplementary Figure 1: Funnel plot, RBBB → PPI (Egger's test: $t = 0.13$, $df = 2$, $p = 0.907$)
- Supplementary Figure 2: Leave-one-out sensitivity analysis, RBBB → PPI
- Supplementary Figure 3: Valve-type subgroup, RBBB → PPI
- Supplementary Figure 4: Original PPI incidence forest plot (n=15,515, with prediction interval)
- Supplementary Figure 5: Funnel plot, PPI incidence (20 studies)
- Supplementary Figure 6: Study era subgroup, PPI incidence
- Supplementary Figure 7: Meta-regression, PPI rate by publication year
- Supplementary Figure 8: LVEF mean difference forest plot (3 studies)

Software: R version 4.6.1 (R Core Team, 2026). Packages: meta (Schwarzer et al.) and metafor (Viechtbauer, 2010). All figures were exported at a minimum resolution of 300 dpi.

Instructions for use:

1. Install R (version 4.0 or later) from <https://cran.r-project.org> and RStudio from <https://posit.co>
2. Install required packages: `install.packages(c("meta", "metafor"))`
3. Open this script in RStudio
4. Click Source to generate all figures at once
5. Main text figures save as Figure_03 through Figure_06; supplementary figures save as Supplementary_Figure_01 through Supplementary_Figure_08

```
# =====
# TAVR/PPM Meta-Analysis – MASTER SCRIPT (CORRECTED, August 2026)
# Manuscript No. 123559 – World Journal of Cardiology
# Author: Tobias K Fuchs
# Co-authors: Cameron Jones, John Patterson
#
# HOW TO USE:
#   1. Open this file in RStudio
#   2. Click SOURCE to generate all 12 figures at once (4 main text, 8 supplementary)
#   3. All figures save as PNG in your working directory
#
# NOTE: Figure 1 (PRISMA) → prisma.thetacollaborative.ca
#       Figure 2 (ROB2) → robvis.net
#       This script generates 4 main text and 8 supplementary figures
#
# FIGURE OUTPUT NAMING:
#   Main text figures:      Figure_03 through Figure_06
```

```

# Supplementary figures: Supplementary_Figure_01 through Supplementary_Figure_08
# Figure 3 = pooled PPI incidence forest (20 studies)
# Figure 4 = valve-type subgroup, PPI incidence
# Figure 5 = new-onset LBBB forest (11 studies, CORRECTED)
# Figure 6 = updated RBBB -> PPI forest (4 studies, OR 4.52, CORRECTED)
#
# Supp Fig 1 = funnel plot RBBB/PPI
# Supp Fig 2 = leave-one-out sensitivity, RBBB/PPI
# Supp Fig 3 = valve subgroup, RBBB/PPI
# Supp Fig 4 = original PPI incidence forest (n = 15,515)
# Supp Fig 5 = funnel plot, PPI incidence
# Supp Fig 6 = study era subgroup, PPI incidence
# Supp Fig 7 = meta-regression, PPI by publication year
# Supp Fig 8 = LVEF mean difference (3 studies)
#
# WITHDRAWN: the original 6-study RBBB/PPI forest (OR 5.26) is no longer
# generated. See the note at the input block for the reason.
#
# WITHDRAWN: the new-onset RBBB pooled analysis and its funnel plot.
# All 12 studies were verified against source; 10 report no new-onset
# RBBB figure and the values entered were new-onset LBBB values. Only
# Khawaja (8/185) and Guetta (3/70) report a usable figure, which is
# not enough to pool.
#
# SOFTWARE: R version 4.6.1
# PACKAGES: meta, metafor
# =====

# install.packages(c("meta", "metafor")) # uncomment if needed
library(meta)
library(metafor)

cat("=====\n")
cat(" TAVR/PPM – Manuscript No. 123559 – Generating All Figures\n")
cat("=====\n\n")

# =====
# DATA SETUP
# =====

# --- WITHDRAWN: original 6-study 2x2 analysis (OR 5.26) ---
# This analysis has been withdrawn in full. None of the six 2x2 tables
# reconciled with its source publication. Auffret was entered as
# 145/363 vs 362/3164; the source reports 137/342 vs 370/2738 among
# patients without a previous pacemaker, and 362 was the RBBB group N
# copied into the control event cell. Naveh's source table has a zero
# cell (all 6 baseline-RBBB patients were paced) and is not estimable.
# Muntane-Carol measures pacing during post-discharge monitoring in a
# cohort from which all peri-procedurally paced patients were excluded.
# The block and its figure are not regenerated.

# --- Figs 5,6 + Supp 1,2,3: Updated 4-study REML (metafor, OR/CI) ---
# Pavlicek (2023) removed: the 11.64 entered for it was that study's
# multivariable OR for ANY bundle branch block, not for RBBB. Its RBBB
# OR is 0.99 (0.98-1.02), univariate, and never entered the model.
# Wasim upper CI corrected 4.58 -> 4.59 (published value).
study <- c("Bagur (2012)", "Chen (2024)",
           "Castro-Mejia (2022)", "Wasim (2025)")

```

```

OR      <- c(8.61, 5.82, 4.30, 2.23)
lower_CI <- c(3.14, 3.31, 1.90, 1.09)
upper_CI <- c(23.67, 10.17, 9.99, 4.59)
n_total <- c(411, 857, 344, 548)
valve_type <- c("BEV", "BEV", "SEV", "Mixed")

log_OR <- log(OR)
log_low <- log(lower_CI)
log_up <- log(upper_CI)
sei <- (log_up - log_low) / (2 * 1.96)

df_main <- data.frame(study, OR, lower_CI, upper_CI, log_OR, sei,
                      n_total, valve_type, stringsAsFactors = FALSE)
res_main <- rma(yi = log_OR, sei = sei, method = "REML", data = df_main)

# --- Figure 3, Figure 4 + Supp 4,5,6,7: PPI incidence – all 20 studies ---
# Note: Bagur total = 822 (full matched cohort) for Supplementary Figure 4;
#       Bagur total = 411 (TAVR subgroup only) for Figure 3 and all others
ppi_study <- c("Muntané-Carol (2021)", "Pavliceck (2023)", "Meduri (2019)",
               "Castro-Mejia (2022)", "Auffret (2017)", "Bagur (2012)",
               "Wasim (2025)", "Chen (2024)", "Dizon (2015)",
               "Natarajan (2022)", "Fraccaro (2011)", "Guetta (2011)",
               "Husser (2016)", "Khawaja (2011)", "Kooistra (2020)",
               "Kostopoulou (2015)", "Ledwoch (2013)", "Naveh (2017)",
               "Rampat (2017)", "Van Gils (2018)")
ppi_events <- c(19, 15, 245, 61, 507, 30, 173, 107, 173, 30,
               25, 28, 23, 81, 341, 10, 386, 38, 64, 66)
ppi_n_fig8 <- c(459, 203, 874, 344, 3527, 822, 548, 857, 2531, 192,
               64, 70, 183, 243, 2804, 45, 1147, 110, 201, 291) # Fig 8: Bagur=822
ppi_n <- c(459, 203, 874, 344, 3527, 411, 548, 857, 2531, 192,
           64, 70, 183, 243, 2804, 45, 1147, 110, 201, 291) # Figs 9+: Bagur=411
ppi_valve <- c("BEV", "Mixed", "SEV/Mech", "SEV", "Mixed", "BEV",
               "Mixed", "BEV", "BEV", "BEV", "SEV", "SEV", "BEV",
               "SEV", "Mixed", "SEV", "Mixed", "Mixed", "Mech", "Mixed")
ppi_era <- c("Post", "Post", "Post", "Post", "Post", "Pre",
            "Post", "Post", "Pre", "Post", "Pre", "Pre", "Post",
            "Pre", "Post", "Pre", "Pre", "Post", "Post", "Post")
pub_year <- c(2021, 2023, 2019, 2022, 2017, 2012, 2025, 2024, 2015,
              2022, 2011, 2011, 2016, 2011, 2020, 2015, 2013, 2017, 2017, 2018)

ppi_df8 <- data.frame(ppi_study, ppi_events, ppi_n=ppi_n_fig8,
                      ppi_valve, ppi_era, stringsAsFactors=FALSE)
ppi_df <- data.frame(ppi_study, ppi_events, ppi_n,
                     ppi_valve, ppi_era, stringsAsFactors=FALSE)

# --- Figure 5: New-onset LBBB (11 studies, n = 4,907) CORRECTED ---
# Van Gils 153/217, Auffret 461/3098 (no-RBBB group), Wasim 58/173 and
# Khawaja 105/185 corrected against source; Chen and Kooistra removed
# because neither reports a new-onset LBBB incidence.
lbbb_study <- c("Muntane-Carol (2021)", "Pavliceck (2023)", "Auffret (2017)",
               "Fraccaro (2011)", "Guetta (2011)", "Khawaja (2011)",
               "Kostopoulou (2015)", "Rampat (2017)", "Van Gils (2018)",
               "Wasim (2025)", "Natarajan (2022)")
lbbb_events <- c( 50, 93, 461, 28, 33, 105, 14, 111, 153, 58, 56)
lbbb_n <- c(459, 203, 3098, 64, 70, 185, 45, 201, 217, 173, 192)

# --- Supp Fig 8: LVEF mean difference (Meduri 2019, Chen 2024, Dizon 2015) ---

```

```
# Mean/SD data extracted from manuscripts
# Experimental = PPM group, Control = No PPM group
lvef_study <- c("Meduri 2019", "Chen 2024", "Dizon 2015")
lvef_e_n <- c(245, 107, 173)
lvef_e_mean <- c(54.0, 55.10, 55.40)
lvef_e_sd <- c(10.0, 2.50, 9.90)
lvef_c_n <- c(629, 750, 2358)
lvef_c_mean <- c(57.0, 58.70, 53.50)
lvef_c_sd <- c(10.0, 12.90, 12.10)

cat("Data setup complete.\n\n")

# =====
# MAIN TEXT FIGURES (Figures 3-6)
# =====

# =====
cat("Generating Figure 6 (main text)...\n")
png("Figure_06_UpdatedForest_RB3B_PFI.png", width = 4400, height = 2000, res = 300)
par(mar = c(5, 4, 4, 2))
forest(res_main,
  slab = df_main$study,
  xlab = "Odds Ratio (log scale)",
  header = c("Study", "Estimate [95% CI]"),
  attransf = exp,
  at = log(c(0.5, 1, 2, 5, 10, 25, 50)),
  ilab = cbind(format(df_main$N_total, big.mark=","),
    df_main$N_valve_type),
  ilab.xpos = c(-7.0, -5.2),
  xlim = c(-9.5, 6),
  cex = 1.05, efac = 1.6,
  mlab = "Pooled OR (REML): 4.52 [95% CI: 2.64\u2013137.74] I\u00b2 = 50.3% p < 0.001")
text(c(-7.0, -5.2), nrow(df_main)+2, c("N","Valve"), font=2, cex=1.05)
dev.off()
cat(" Saved: Figure_06_UpdatedForest_RB3B_PFI.png\n\n")

# =====
cat("Generating Figure 3 (main text)...\n")
res_ppi <- metaprop(event=ppi_events, n=ppi_n,
  studlab=ppi_study, method="GLMM",
  sm="PLOGIT", random=TRUE, common=FALSE,
  data=ppi_df)
png("Figure_03_PPI_Incidence_GLMM.png", width=3400, height=4200, res=300)
forest(res_ppi,
  sortvar = ppi_events/ppi_n,
  xlab="PPI Rate", cex=0.82,
  col.diamond="black",
  print.I2=TRUE, print.tau2=TRUE)
dev.off()
cat(" Saved: Figure_03_PPI_Incidence_GLMM.png\n\n")

# =====
cat("Generating Figure 4 (main text)...\n")
res_ppi_valve <- metaprop(event=ppi_events, n=ppi_n,
  studlab=ppi_study, subgroup=ppi_valve,
  method="GLMM", sm="PLOGIT",
```

```

        random=TRUE, common=FALSE, data=ppi_df)
png("Figure_04_ValveSubgroup_PPI_Incidence.png", width=3600, height=5000, res=300)
forest(res_ppi_valve,
      xlab="PPI Rate by Valve Type", cex=0.80, col.diamond="black")
dev.off()
cat("  Saved: Figure_04_ValveSubgroup_PPI_Incidence.png\n\n")

# =====
cat("Generating Figure 5 (main text)...\n")
res_lbbb <- metaprop(event=lbbb_events, n=lbbb_n,
  studlab=lbbb_study, method="GLMM",
  sm="PLOGIT", random=TRUE, common=FALSE)
png("Figure_05_NewOnsetLBBB_Forest.png", width=3400, height=3000, res=300)
forest(res_lbbb,
  xlab="New-Onset LBBB Rate", cex=0.85,
  col.diamond="black",
  print.I2=TRUE, print.tau2=TRUE)
dev.off()
cat("  Saved: Figure_05_NewOnsetLBBB_Forest.png\n\n")

# =====
# SUPPLEMENTARY FIGURES (Supplementary Figures 1-8)
# =====

# =====
cat("Generating Supplementary Figure 1...\n")
egger_test <- regtest(res_main, model = "lm")
png("Supplementary_Figure_01_FunnelPlot_RBBB_PPI.png", width = 2800, height = 2600, res = 300)
par(mar = c(5, 5, 5, 3))
funnel(res_main,
  xlab = "Log Odds Ratio", ylab = "Standard Error",
  main = "Funnel Plot: Baseline RBBB and PPI After TAVR",
  refline = 0, level = c(90, 95, 99),
  shade = c("white", "gray85", "gray70"),
  pch = 19, col = "black", cex = 1.3,
  back = "white", hlines = NULL)
text(df_main$log_OR + 0.07, df_main$sei,
  labels = c("Bagur", "Chen", "Castro-Mejia", "Wasim"),
  cex = 0.82, adj = c(0, 0.5))
mtext(paste0("Egger's test: z = ", round(egger_test$zval,2),
  ", p = ", round(egger_test$pval,3)),
  side=1, line=4, cex=0.85)
dev.off()
cat("  Saved: Supplementary_Figure_01_FunnelPlot_RBBB_PPI.png\n\n")

# =====
cat("Generating Supplementary Figure 2...\n")
loo_OR <- loo_lb <- loo_ub <- numeric(4)
for (i in 1:4) {
  tmp <- rma(yi=df_main$log_OR[-i], sei=df_main$sei[-i], method="REML")
  loo_OR[i] <- exp(tmp$beta)
  loo_lb[i] <- exp(tmp$ci.lb)
  loo_ub[i] <- exp(tmp$ci.ub)
}
loo_labels <- paste0("Omitting ", df_main$study)

```



```

png("Supplementary_Figure_02_LeaveOneOut_RBBB_PPI.png", width = 4000, height = 2000, res = 300)
par(mar = c(5, 10, 5, 7))
plot(loo_OR, 4:1, xlim=c(1.5,11), ylim=c(0.3,5.2),
     xlab="Pooled OR (95% CI) with Study Omitted",
     yaxt="n", ylab="", pch=18, cex=1.8, col="black",
     main="Leave-One-Out Sensitivity Analysis\nBaseline RBBB \u2192 PPI After TAVR")
for (i in 1:4) lines(c(loo_lb[i],loo_ub[i]), c(5-i,5-i), lwd=2)
abline(v=4.52, lty=2, col="firebrick", lwd=2)
text(4.65, 4.90, "Full pooled OR = 4.52", col="firebrick", cex=0.82, adj=0)
axis(2, at=4:1, labels=loo_labels, las=1, cex.axis=0.88)
for (i in 1:4) {
  text(loo_ub[i]+0.4, 5-i,
       paste0(round(loo_OR[i],2)," [" ,round(loo_lb[i],2),
              "\u2013",round(loo_ub[i],2),"]"),
       adj=0, cex=0.80)
}
dev.off()
cat(" Saved: Supplementary_Figure_02_LeaveOneOut_RBBB_PPI.png\n\n")

# =====
cat("Generating Supplementary Figure 3...\n")
# NOTE: the previous version passed an already-reordered slab AND order=ord,
# which permuted the labels relative to the estimates. slab is now passed
# unordered so that forest() reorders labels and estimates together.
ord <- order(df_main$valve_type)
rows <- c(6,5,3,1)

png("Supplementary_Figure_03_ValveSubgroup_RBBB_PPI.png", width=4400, height=3000, res=300)
par(mar=c(5,4,4,2))
forest(res_main,
      slab = paste0(df_main$study, " [" ,df_main$valve_type,"]"),
      xlab = "Odds Ratio (log scale)",
      header = c("Study [Valve Type]","Estimate [95% CI]"),
      attransf=exp, at=log(c(0.5,1,2,5,10,25,50)),
      xlim=c(-8,6), rows=rows, ylim=c(-2,10),
      order=ord, cex=1.05, efac=1.6,
      mlab="Pooled OR (REML): 4.52 [95% CI: 2.64\u20137.74] I\u00b2 = 50.3%")
text(-8, 7.2, "Balloon-Expandable (BEV)", font=4, adj=0, cex=0.95)
text(-8, 4.0, "Mixed Valve Platform", font=4, adj=0, cex=0.95)
text(-8, 2.0, "Self-Expanding (SEV)", font=4, adj=0, cex=0.95)
abline(h=4.2, lty=2, col="gray50")
abline(h=2.2, lty=2, col="gray50")
dev.off()
cat(" Saved: Supplementary_Figure_03_ValveSubgroup_RBBB_PPI.png\n\n")

# =====
cat("Generating Supplementary Figure 4...\n")
res_ppi8 <- metaprop(event=ppi_events, n=ppi_n_fig8,
                    studlab=ppi_study, method="GLMM",
                    sm="PLOGIT", random=TRUE, common=FALSE,
                    data=ppi_df8)
png("Supplementary_Figure_04_PPI_Incidence_Original.png", width=3400, height=4400, res=300)
forest(res_ppi8,
      xlab = "Incidence of New Permanent Pacemaker",
      cex = 0.82, col.diamond="black",
      print.I2=TRUE, print.tau2=TRUE,
      prediction=TRUE)

```

```

dev.off()
cat("  Saved: Supplementary_Figure_04_PPI_Incidence_Original.png\n\n")

# =====
cat("Generating Supplementary Figure 5...\n")
png("Supplementary_Figure_05_FunnelPlot_PPI_Incidence.png", width=2800, height=2600, res=300)
funnel(res_ppi,
      xlab="Logit Transformed Proportion",
      ylab="Standard Error",
      main="Funnel Plot: PPI Incidence After TAVR (20 Studies)",
      pch=19, col="black", cex=1.1,
      studlab=TRUE, cex.studlab=0.55)
dev.off()
cat("  Saved: Supplementary_Figure_05_FunnelPlot_PPI_Incidence.png\n\n")

# =====
cat("Generating Supplementary Figure 6...\n")
res_ppi_era <- metaprop(event=ppi_events, n=ppi_n,
      studlab=ppi_study, subgroup=ppi_era,
      method="GLMM", sm="PLOGIT",
      random=TRUE, common=FALSE, data=ppi_df)
png("Supplementary_Figure_06_EraSubgroup_PPI_Incidence.png", width=3400, height=4200, res=300)
forest(res_ppi_era,
      xlab="PPI Rate by Study Era", cex=0.82, col.diamond="black")
dev.off()
cat("  Saved: Supplementary_Figure_06_EraSubgroup_PPI_Incidence.png\n\n")

# =====
cat("Generating Supplementary Figure 7...\n")
ppi_log_OR <- log((ppi_events+0.5)/(ppi_n-ppi_events+0.5))
ppi_sei2 <- sqrt(1/(ppi_events+0.5)+1/(ppi_n-ppi_events+0.5))
res_mr <- rma(yi=ppi_log_OR, sei=ppi_sei2, mods=~pub_year, method="REML")

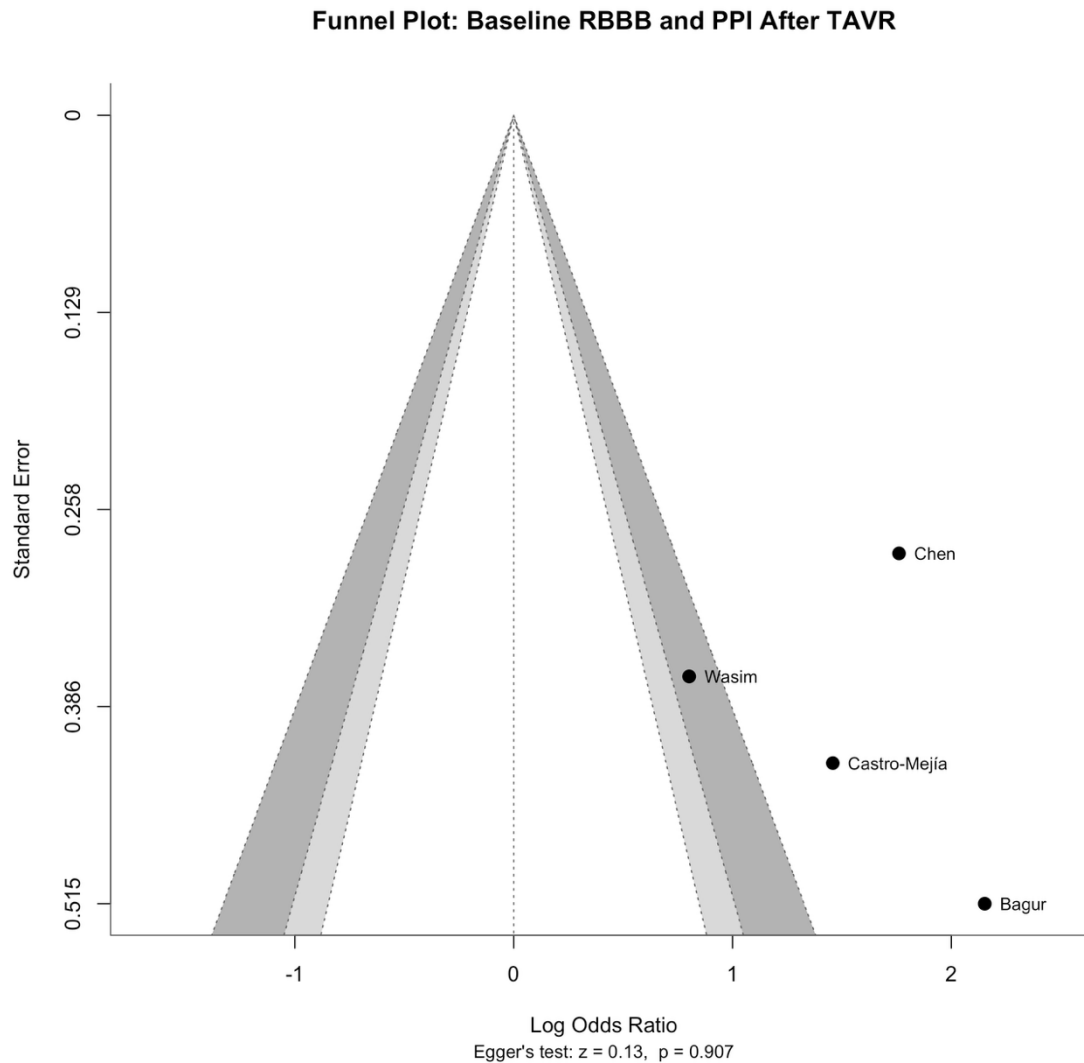
png("Supplementary_Figure_07_MetaRegression_PPI_by_Year.png", width=3400, height=2600, res=300)
par(mar=c(5,5,5,3))
regplot(res_mr,
      xlab="Publication Year",
      ylab="Log Odds of PPI Rate",
      main="Meta-Regression: PPI Rate by Publication Year",
      col="steelblue", bg="lightblue",
      pch=21, label=TRUE, labsize=0.72)
dev.off()
cat("  Saved: Supplementary_Figure_07_MetaRegression_PPI_by_Year.png\n\n")

# =====
cat("Generating Supplementary Figure 8...\n")
res_lvef <- metacont(n.e=lvef_e_n, mean.e=lvef_e_mean, sd.e=lvef_e_sd,
      n.c=lvef_c_n, mean.c=lvef_c_mean, sd.c=lvef_c_sd,
      studlab=lvef_study,
      sm="MD", random=TRUE, common=TRUE)

png("Supplementary_Figure_08_LVEF_MeanDifference.png", width=4200, height=1800, res=300)
forest(res_lvef,
      xlab="Mean Difference in LVEF (PPI vs No PPI, %)",
      smlab="",
      leftcols=c("studlab", "n.e", "mean.e", "sd.e", "n.c", "mean.c", "sd.c"),

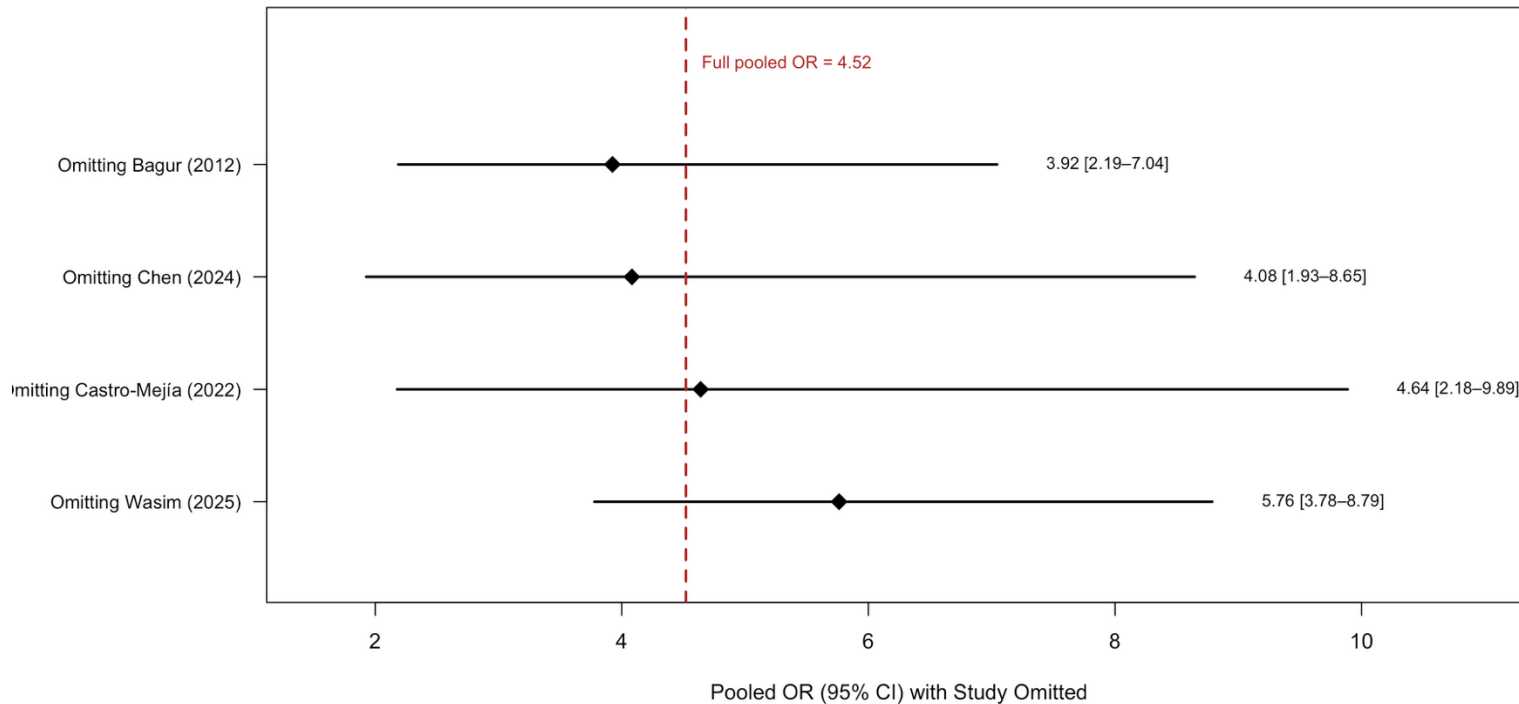
```

```
leftlabs=c("Study","Total","Mean","SD","Total","Mean","SD"),
label.e="PPM", label.c="No PPM",
col.diamond.common="black",
col.diamond.random="black",
print.tau2=TRUE,
cex=0.90)
dev.off()
cat("  Saved: Supplementary_Figure_08_LVEF_MeanDifference.png\n\n")
```

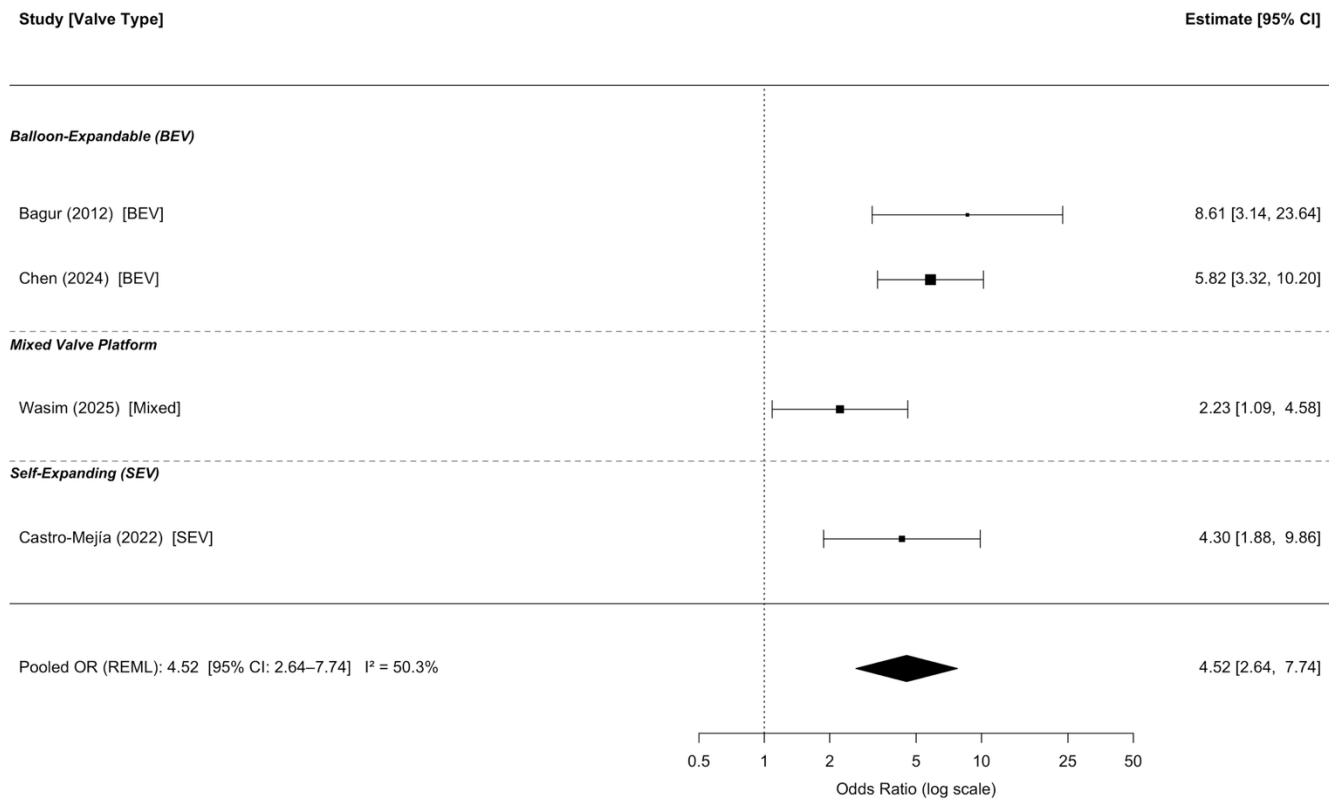


Supplementary Figure 1. Funnel plot for assessment of publication bias in the meta-analysis of baseline right bundle branch block (RBBB) and permanent pacemaker implantation (PPI) after transcatheter aortic valve replacement (TAVR). Each dot represents one study. Egger's test: $t = 0.13$, $df = 2$, $P = 0.907$, indicating no statistically significant funnel plot asymmetry; with only four contributing studies this assessment has very limited power. RBBB: Right bundle branch block; PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement.

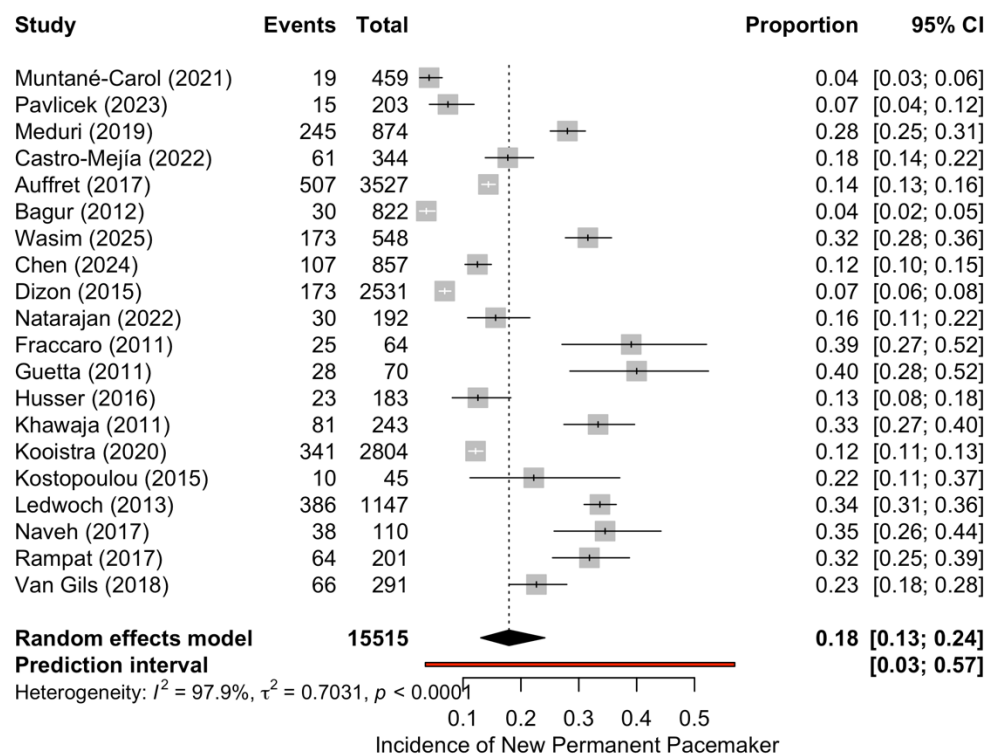
Leave-One-Out Sensitivity Analysis Baseline RBBB → PPI After TAVR



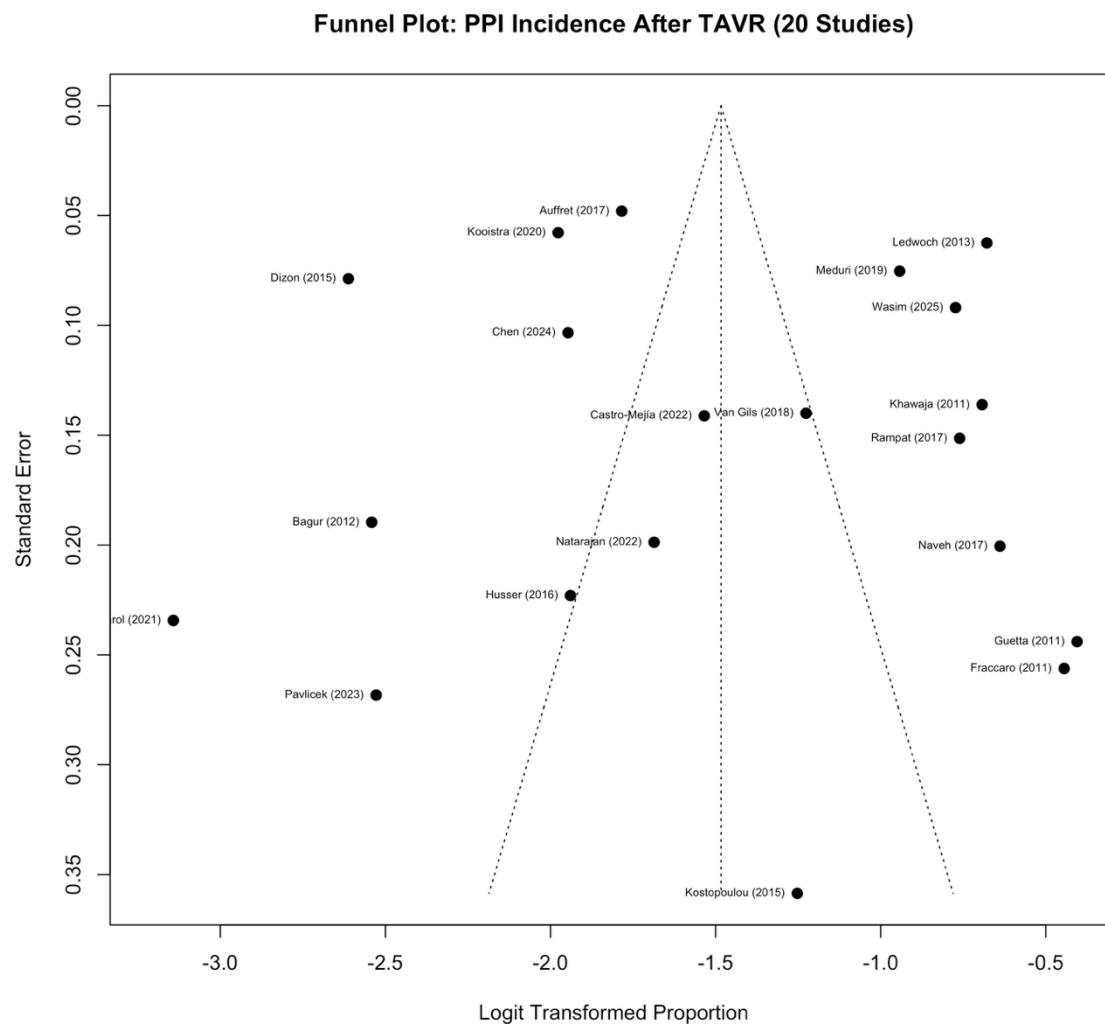
Supplementary Figure 2. Leave-one-out sensitivity analysis for the meta-analysis of baseline right bundle branch block (RBBB) and permanent pacemaker implantation (PPI) after transcatheter aortic valve replacement (TAVR). Each row shows the pooled odds ratio (OR) after sequentially omitting the indicated study. Pooled ORs ranged from 3.92 to 5.76 across all omission scenarios. The dashed red line denotes the full pooled OR (4.52). OR: Odds ratio; CI: Confidence interval; RBBB: Right bundle branch block; PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement.



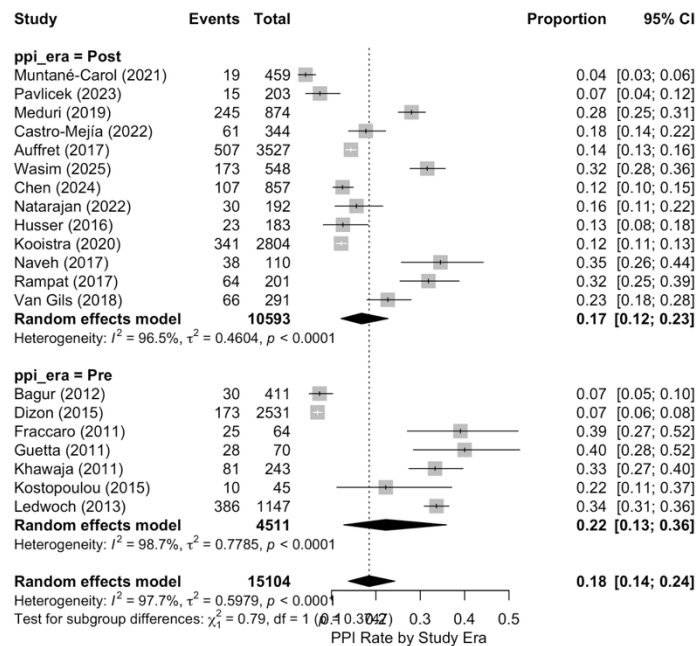
Supplementary Figure 3. Valve-type subgroup analysis of the association between pre-existing right bundle branch block (RBBB) and permanent pacemaker implantation (PPI) after transcatheter aortic valve replacement (TAVR). Studies are grouped by valve platform: balloon-expandable (BEV), mixed, and self-expanding (SEV). The association between baseline RBBB and PPI was directionally consistent across all platform subgroups. Pooled OR (REML) 4.52 (95% CI: 2.64–7.74); $I^2=50.3\%$. OR: Odds ratio; CI: Confidence interval; BEV: Balloon-expandable valve; SEV: Self-expanding valve; RBBB: Right bundle branch block; PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement.



Supplementary Figure 4. Forest plot depicting pooled incidence of new permanent pacemaker implantation (PPI) following transcatheter aortic valve replacement (TAVR) across 20 studies (n=15,515). Random-effects model; pooled proportion 0.18 (95% CI: 0.13–0.24); $I^2=97.9\%$, indicating substantial heterogeneity, with a 95% prediction interval of 0.03 to 0.57. This analysis uses the full matched cohort from Bagur et al and therefore differs in denominator from the primary analysis presented in Figure 3. Each row represents one study; square size reflects study weight; diamond represents pooled estimate. PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement; CI: Confidence interval.

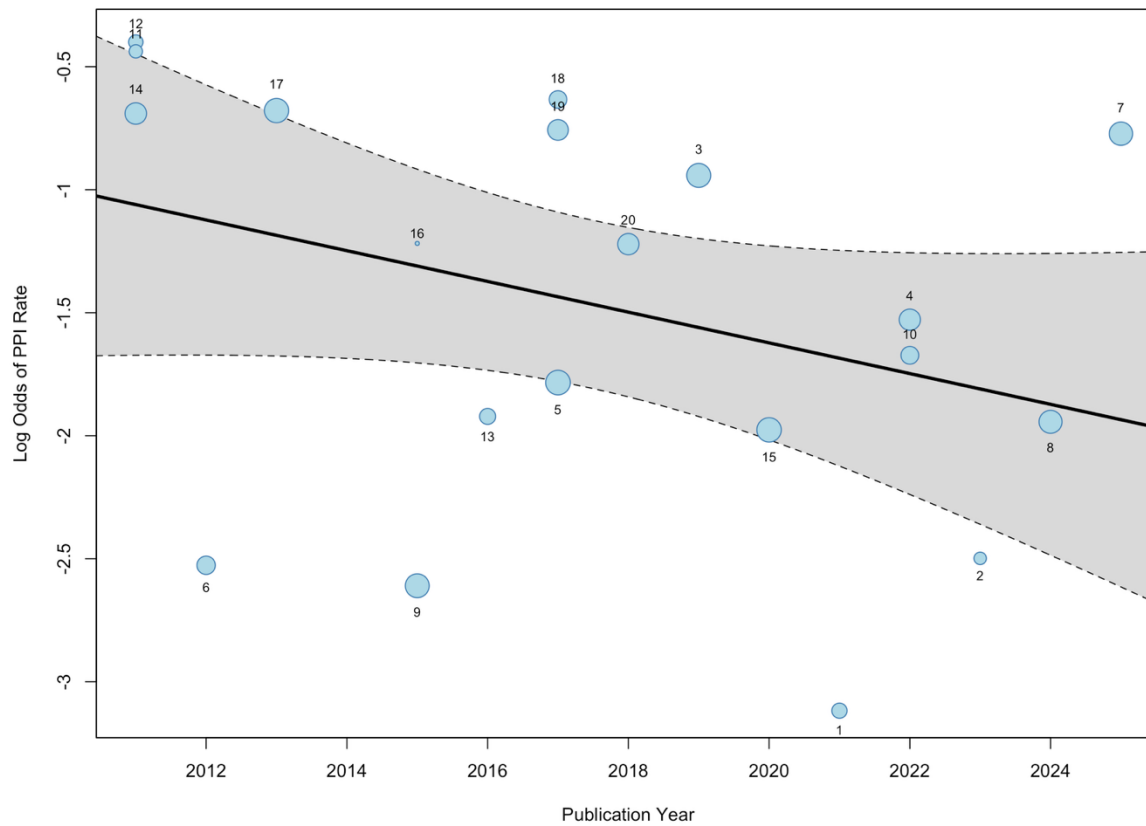


Supplementary Figure 5. Funnel plot for assessment of publication bias across studies reporting incidence of new permanent pacemaker implantation (PPI) after transcatheter aortic valve replacement (TAVR). Each point represents one study. Asymmetry may suggest publication bias or small-study effects. PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement.

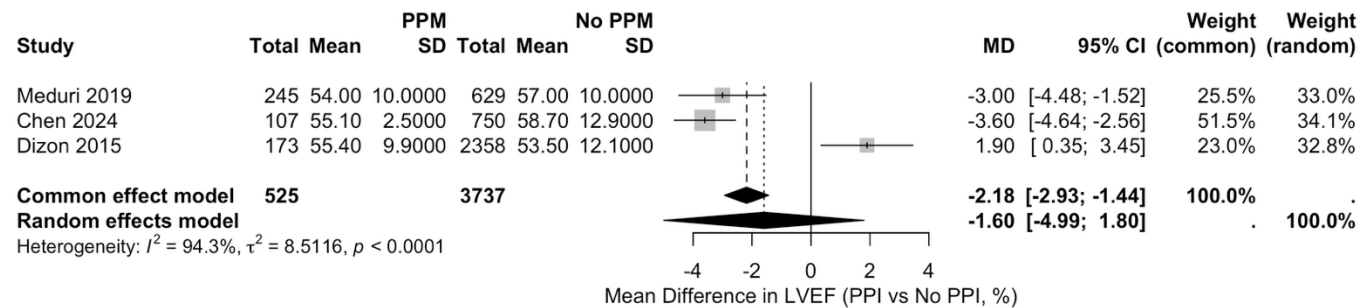


Supplementary Figure 6. Study era subgroup analysis of pooled permanent pacemaker implantation (PPI) incidence following transcatheter aortic valve replacement (TAVR). Post-2016 cohorts: pooled proportion 0.17 (95% CI: 0.12–0.23; $I^2=96.5\%$); pre-2016 cohorts: 0.22 (95% CI: 0.13–0.36; $I^2=98.7\%$). Between-group difference: $\chi^2=0.79$, $df=1$, $P=0.374$. PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement; CI: Confidence interval.

Meta-Regression: PPI Rate by Publication Year



Supplementary Figure 7. Meta-regression of permanent pacemaker implantation (PPI) rate (log odds) on publication year across 20 studies. Each bubble represents one study; bubble size reflects study weight. Regression slope = -0.06 per year; $P=0.118$, indicating a negative trend in PPI rate over the study period that did not reach statistical significance. The shaded region represents the 95% confidence band. PPI: Permanent pacemaker implantation.



Supplementary Figure 8. Forest plot depicting mean difference in left ventricular ejection fraction (LVEF) between patients requiring PPI and those not requiring PPI following transcatheter aortic valve replacement (TAVR) across three studies (n=4,262). Random-effects model; mean difference -1.60 (95% CI: -4.99 to 1.80); $I^2=94.3\%$, indicating substantial heterogeneity. The three contributing studies were not directionally consistent: Meduri and Chen reported lower LVEF in paced patients, whereas Dizon reported a higher LVEF in the paced group (mean difference +1.90, 95% CI: 0.35 to 3.45). Given the limited number of contributing studies, the high heterogeneity, and this directional inconsistency, these data are interpreted descriptively. LVEF: Left ventricular ejection fraction; PPI: Permanent pacemaker implantation; TAVR: Transcatheter aortic valve replacement; MD: Mean difference.

