R packages

⬚ Complexity Masquerading as Flexibility

R packages like *meta* and *metafor* are widely praised for their flexibility and power, but this very flexibility masks profound usability and epistemic challenges.

- The steep learning curve is **insurmountable for non-experts**, locking out clinicians, policymakers, and many researchers who lack advanced programming skills.
- The complexity leads to **inconsistent usage**, mistakes, and poor reproducibility among less experienced users.
- Lack of standardization in code means identical analyses can yield subtly different results depending on user coding style and package versions.

⬚ Minimal Safeguards Against User Error

- These packages provide **few guardrails** or warnings to prevent misuse of statistical models.
- Users can easily run inappropriate models (e.g., fixed effects vs. random effects) without clear guidance.
- There is no built-in **methodological advisory** system to flag data quality issues or model assumptions violations.

This can result in **statistically invalid or misleading meta-analyses** being produced and published.

⬚ No Integrated Workflow or Automation

- R packages operate as **standalone statistical tools** without integration into literature screening, data extraction, or bias assessment.
- Critical upstream processes remain **manual and error-prone**, undermining the quality of input data.
- There is no seamless connection with AI tools or databases to streamline evidence synthesis.

⬚ Reproducibility and Transparency Challenges

- Although R supports scripting, **inconsistent documentation, versioning, and environment management** often impair true reproducibility.
- Lack of standard templates or protocols leads to fragmented workflows and difficulties in peer review.
- Reproducible research requires additional tooling (e.g., R Markdown, Docker), increasing technical burden.

⚠ Accessibility and Equity Issues

- The requirement for coding expertise effectively **excludes non-technical researchers** and

clinicians.
- This perpetuates a digital divide, where only well-resourced teams can perform advanced meta-analyses.
- User errors from insufficient training may introduce bias and erode trust in published syntheses.

⚖ Final Verdict

R meta-analysis packages like *meta* and *metafor* offer immense power in the hands of experts but **are epistemic minefields for the uninitiated**. Their complexity, lack of safeguards, and disconnected workflows risk producing irreproducible, invalid, or misleading results.

Recommendation: Only use these tools with rigorous statistical training, standardized protocols, and comprehensive workflow management. For broader accessibility and reliability, consider GUI-based or integrated platforms with built-in methodological guidance.

Better Alternatives to R Meta-Analysis Packages

⭐ Comprehensive Meta-Analysis (CMA)

- ⬜ Intuitive graphical interface, no coding required
- ⬜ Supports rich statistical models, subgroup and sensitivity analyses
- ⬜ Built-in methodological guidance reduces user errors
- ⬜ **Why better than R packages:**

Accessible to non-programmers with powerful features and guided workflows

⭐ JASP

- ⬜ Free and open-source GUI software
- ⬜ Supports both frequentist and Bayesian meta-analysis methods
- ⬜ Integrates with R backend but hides complexity from users
- ⬜ **Why better than R packages:**

User-friendly interface with reproducible output ideal for teaching and exploration

⭐ AI-Augmented Tools: Elicit + RobotReviewer

- ⬜ Automates literature screening, data extraction, and risk of bias assessment
- ⬜ Reduces manual workload and potential human error
- ⬜ **Why better than R packages:**

Automates upstream processes typically manual in R workflows

⬚ Workflow Platforms: Covidence, DistillerSR

- ⬚ Comprehensive platforms managing screening, extraction, bias assessment, and export
- ⬚ Collaboration-friendly with version control and audit trails
- ⬚ **Why better than R packages:**

Supports the entire systematic review lifecycle, not just meta-analysis

⬚ Summary Table

Tool	Strengths	Why Better Than R Packages
Comprehensive Meta-Analysis (CMA)	GUI-based, rich stats, guidance	No coding needed; robust statistical options
JASP	Free, supports Bayesian and frequentist	User-friendly, reproducible
Elicit + RobotReviewer	AI-assisted data extraction and bias assessment	Automates tedious manual steps
Covidence / DistillerSR	Full systematic review workflow support	Covers full SR lifecycle, collaboration

⬚ Final Recommendation

- Use **CMA or JASP** for powerful, code-free meta-analysis.
- Use **Elicit and RobotReviewer** to streamline data extraction and quality assessment.
- Use **Covidence or DistillerSR** to manage the entire systematic review process.
- Use **R packages** only if you have advanced coding skills and need full customization.