Impact Surgery

Brief research report

e-ISSN: 3033-4470

# Meta-Suite: an IDEAL phase 2a report of an app for interactive, accessible, and transparent meta-analysis using R-Shiny

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## Abstract

**Introduction:** : Meta-analysis is a powerful model for combining findings from multiple studies on a topic. Due to the growing complexity and amount of data in the digital age, research requires user-friendly tools for complex data analysis. This IDEAL phase 2a study introduces Meta-Suite, which aims to simplify statistical analysis for meta-analysis with R.

**Methods:** Meta-Suite was developed with R and Shiny to provide an intuitive General User Interface (GUI) for meta-analyses. It combines various R programs, such as meta, metasens, and metafor, and provides tools for data visualization, risk of bias evaluation, and quality assessment of randomized controlled trials and observational studies.

**Results:** Meta-Suite facilitates data input, analysis, and visualization simply, enabling users to focus on their academic writing and reducing statistical analysis load. The application allows for plot customization and provides quick feedback, which improves data understanding and decision-making. It can assist in conducting meta-analyses, creating plots, and downloading them using a user-friendly interface.

**Conclusion:** Meta-Suite offers a simple and user-friendly interface for conducting meta-analyses, allowing novice to access complex statistical methods. Robust user validation tests are now required to test and improve its functionality.

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## Introduction

Meta-analysis is a powerful model for combining findings from multiple studies on a topic [1]. Researchers can compare study results using meta-analysis, which combines findings from multiple studies to estimate healthcare outcomes more accurately [2,3]. Data growth and complexity in the digital age have made academic research harder. A user-friendly tool that lets researchers, including non-statisticians and students, use advanced data analysis techniques for meta-analysis is in demand. Our tool allows researchers, especially beginners, to conduct complex meta-analyses using a web browser without specialized knowledge. This study provides an IDEAL phase 2a (Development) report for Meta-Suite, a shiny interactive app, for meta-analyses.

**Cite as:** Ganduboina, R., Dutta, P., Pawar, S., & Mukherjee, I. (2024). The Meta-Suite: An innovative app for interactive, accessible, and transparent meta-analysis using R-Shiny. *Impact Surgery*, 1(5), 195–198. https://doi.org/10.62463/surgery.84

## Methodology

*Meta Suite*

Meta-Suite is simple and user-friendly web-based software designed specifically for performing various steps of a meta-analysis. This software simplifies complex data analysis and meta-plot creation with its powerful tools. The free version at https://rohitganduboina.shinyapps.io/META-SUITE/ works with all modern browsers.

*User interface*

The web-based General User Interface (GUI) was created using R-Shiny [4]. It features a user-friendly interface, as seen in Figure 1. Authors independently assessed tool applicability.

*Development*

Existing packages were used to develop apps. We chose Shiny and these R meta-analyses packages because of their intricate structure and peer-review profile [3]. The IDEAL Framework was used to ensure Meta-Suite, our meta-analysis tool, meets the research and innovation standards. Our tool is in Ideal Stage 2a (Development) [5].

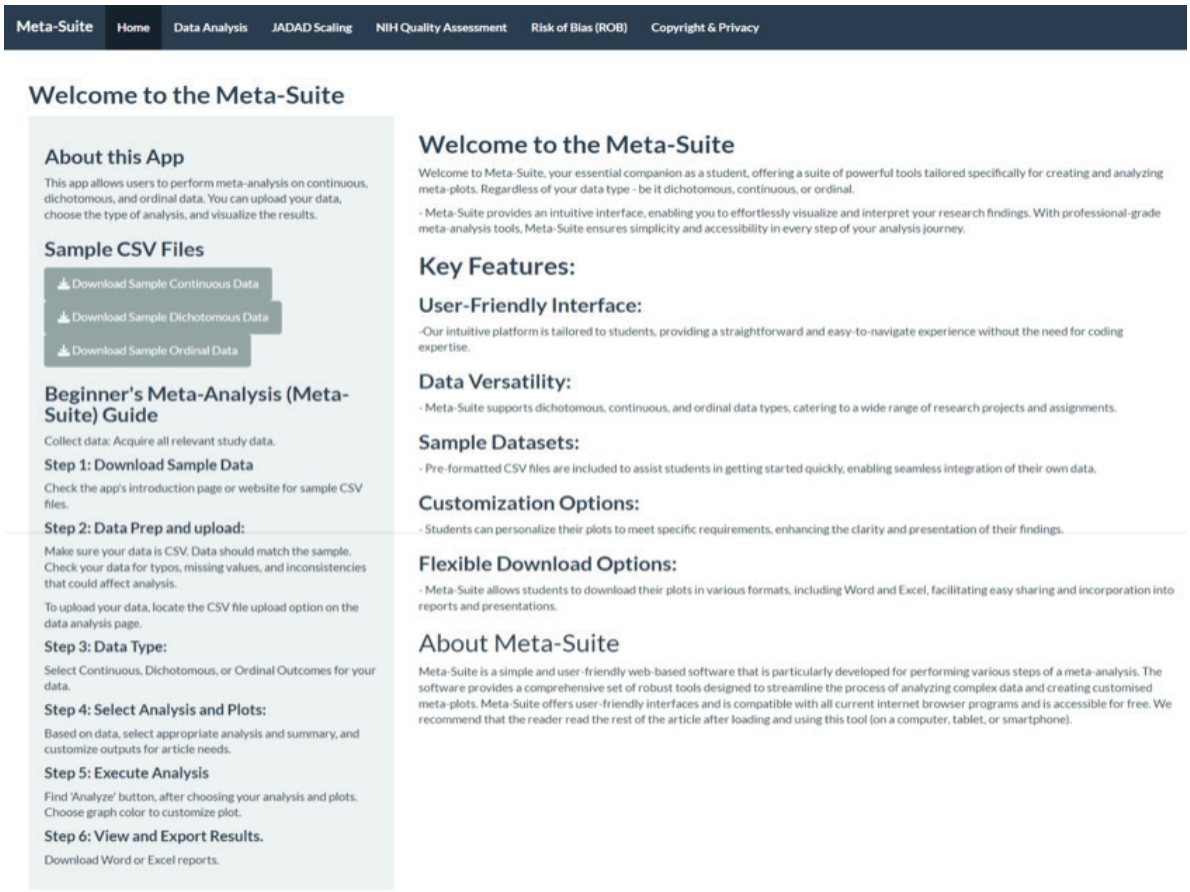
## Results

Meta-Suite simplifies data comprehension and decision-making with point-and-click visualizations of analytical and meta-analytical methods. The instantaneous feedback mechanism helps users evaluate analytical methods quickly.

Shiny helps R users interact with statistical data via a flexible web interface. With this structure, users don't need to install R or other software, improving user experience while maintaining R's robustness and flexibility for complex meta-analyses.

Shiny, shiny themes, and DT were used to create the web-based GUI [6-7]. Robvis visualized risk-of-bias assessments [8]. Meta, metasens, and metafor were used for meta-analysis [9-11]. Data manipulation like filtering, grouping, and aggregating was done with dplyr [12]. GUI displayed live data graphs using ggplot2 and grid packages, but forest plot was created using meta to maintain quality [9, 13, 14]. Interactivity and visual outputs were improved with HTML widgets and webshot2 [15, 16]. The writexl library provided Excel worksheet creation and management, while the officer library

**Figure1:** General User Interface of Meta-Suite



supported document creation [17, 18]. The development environment included RStudio 2024.04.2+764 and R 4.4.0. [19, 20].

## Discussion

Meta-Suite is a shiny based software aiming to make meta-analyses more accessible for junior researchers who may not have significant background in statistical analysis. It offers a user-friendly interface using R-Shiny [4] and uses various tools such as meta, metasens, metafor, and dplyr for reliable meta-analysis and data handling [9-12]. The platform streamlines data management and intricate analyses, improving research transparency, replicability, and precision.

Users can engage with data and offer immediate feedback on analytical methods through the user-friendly interface. Various tools and assessments, such as meta-plots, JADAD Scaling that evaluates RCTs using specific criteria, The NIH Quality Assessment tool that evaluates cross-sectional and observational studies using specific criteria and Meta-Suite's RoB feature that examines and displays study bias using Cochrane RoB2 can be tailored to meet specific research needs. These customizable tools not only promote transparency in research but facilitate decision-making across different disciplines [21-23].

There are limitations to this report, including the absence of user assessment and validation, reliance on web-based interfaces, and the absence of a comprehensive range of complex statistical models and customization options found in more advanced R packages. User validation, compared to existing real-world standards, are needed to test the app's robustness.

**Acknowledgments:** Cankutay Muderrisoglu assisted in development of this paper.

**Funding:** There is no funding to disclose.

**Competing interests:** Rohit Ganduboina owns the Meta-Suite app.

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