

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 metaanalyses, allowing novice to access complex statistical methods. Robust user validation tests are now required to test and improve its functionality.

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.

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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].

Meta-Suite Home Data Analysis JADAD Scaling NIH Quality Assessment Risk of Bias (ROB) Copyright & Privacy

Figure1: General User Interface of Meta-Suite

Download Word or Excel reports.

Results

Meta-Suite simplifies data comprehension and decisionmaking 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

Welcome to the Meta-Suite Welcome to the Meta-Suite About this App Welcome to Meta-Suite, your essential companion as a student, offering a suite of powerful tools tailored specifically for creating and analyzing This app allows users to perform meta-analysis on contin dichotomous, and ordinal data. You can upload your data, choose the type of analysis, and visualize the results. meta-plots. Regardless of your data type - be it dichotomous, continuous, or ordinal Meta-Suite provides an intuitive interface, enabling you to effortlessly visualize and interpret your research findings. With professional-grade meta-analysis tools, Meta-Suite ensures simplicity and accessibility in every step of your analysis journey. Sample CSV Files **Key Features:** A Deverteed Completion Continuous Dat **User-Friendly Interface:** -Our intuitive platform is tailored to str ents, providing a straightforward and easy-to-navigate experience without the need for coding expertise Data Versatility: Beginner's Meta-Analysis (Meta-Meta-Suite supports di is, continuous, and ordinal data types, catering to a wide range of research projects and assign Suite) Guide Collect data: Acquire all relevant study data Sample Datasets: Step 1: Download Sample Data Pre-formatted CSV files are included to assist students in getting started quickly, enabling sea Check the app's introduction page or website for sample CSV **Customization Options:** Step 2: Data Prep and upload: Students can personalize their plots to r ific requirements, enhancing the clarity and presentation of their findings. Make sure your data is CSV. Data should match the sample. Check your data for typos, missing values, and inconsistencies that could affect analysis. Flexible Download Options: Meta-Suite allows students to do load their plots in various formats, including Word and Excel, facilitating easy sharing and incorporation into To upload your data, locate the CSV file upload option on the reports and presentations. data analysis pa Step 3: Data Type: About Meta-Suite Meta-Suite is a simple and user-friendly web-based software that is particularly developed for performing various steps of a meta-analysis. The software provides a comprehensive set of robust tools designed to streamline the process of analyzing complex data and creating customised meta-plots. Meta-Suite offers user-friendly interfaces and is compatible with all current internet browser programs and is accessible for free. We recommend that the reader read the rest of the article after loading and using this tool (on a computer, tablet, or smartphone). Select Continuous, Dichotomous, or Ordinal Outcomes for your Step 4: Select Analysis and Plots: Based on data, select appropriate analysis and summary, and customize outputs for article needs. Step 5: Execute Analysis Find 'Analyze' button, after choosing your analysis and plots. anh color to cus Step 6: View and Export Results.



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 userfriendly 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 webbased 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.

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