Xmeta-COVID19: A Comprehensive Web-based Toolbox for Meta-analysis on COVID19 Research

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Abstract

Background and Objectives:
The 2019 novel coronavirus disease pandemic, also known as COVID-19 pandemic, is a new and severe public health crisis that rapidly spread all around the world. A large number of ongoing studies are investigating the effectiveness and safety of various treatments and interventions for COVID-19. There is a critical need of high-quality systematic review and meta-analysis to assist the investigators to efficiently and accurately synthesize the available evidence from the published biomedical literature toward better informed clinical decision making.

Materials and Methods:
We developed a web-based platform for the users to conduct meta-analysis for COVID-19 related studies (https://www.xmeta.org). This platform is designed to provide an environment to meta-analyze data quickly and safely without requiring any programming skills. The platform is composed of five parts: (1) interface design by R shiny, (2) backend computation with R, (3) database management with elasticseach, (4) exploratory data analysis using Kibana, and (5) interconnect architecture (Figure 1). These parts together offer efficient and comprehensive meta-analyses of study-level summary data, with data visualizations, sensitivity analyses, and model diagnoses such as study of heterogeneity, evaluation of publication bias and outcome reporting bias.
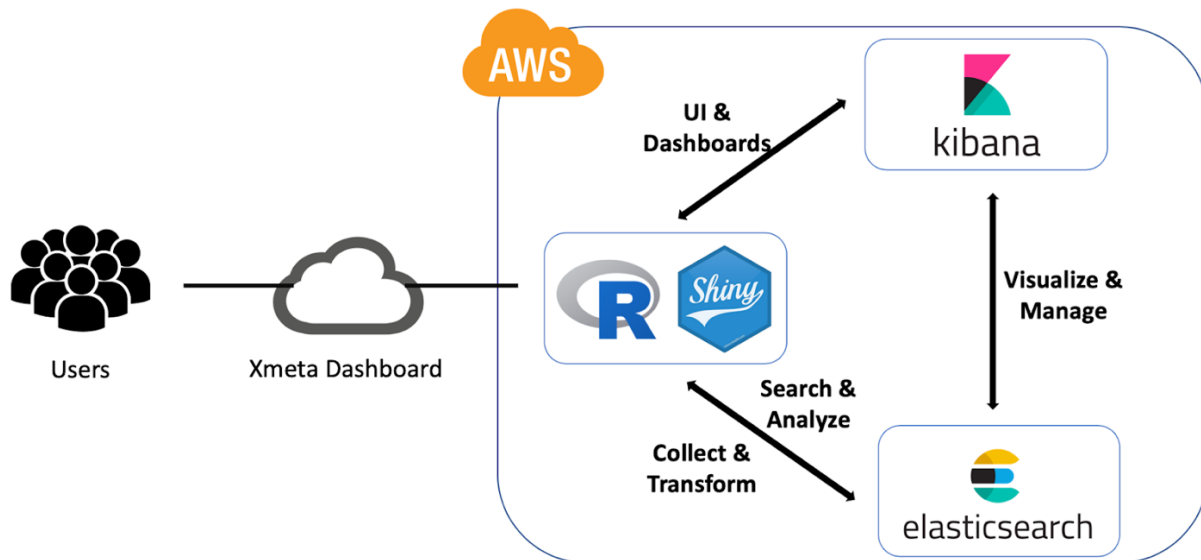
Figure 1. The architecture of Xmeta interconnect technology stack: Shiny, Elasticsearch, and Kibana hosted with AWS.

Results:
We performed a case study by conducting a systematic review and meta-analysis with the Xmeta online platform. The platform was validated with the data from 19 COVID19 studies and provided a comprehensive dynamic report to assist the further investigation.

Discussion and Conclusions:

The Xmeta online platform represents a useful advancement in meta-analysis tool by allowing semi-automated comprehensive and advanced analysis methods, exploratory and statistical data visualization, and dynamic analysis reports. User-wise profiles and data management features are being added to the web platform in the future. In addition, we also plan to incorporate our platform with literature review tools, such as the AI-assisted NLP approaches for information annotation and retrieval.