Interactive Visual Exploration of Pairwise Meta-Analysis Results

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Introduction

Cancer is a significant health problem, and its treatment can lead to physical and psychological issues which affect a patient's quality of life directly. A comprehensive summary of the treatment plan's benefit and harm outcomes will not only help researchers improve drug development, but also help clinicians make clinical decisions.

To summarize the findings and synthesize evidence for important clinical questions, pairwise meta-analyses (PMAs) are used to get precise estimates of treatment effects. However, it's challenging to explore the PMA results as complexity of clinical questions increase involving a huge number of studies and outcomes.

To address these limitations, we propose a visual analytics system to facilitate the PMA result exploration. Using this system, clinicians and patients can visualize the relevant data for shared decision making.

Task Analysis

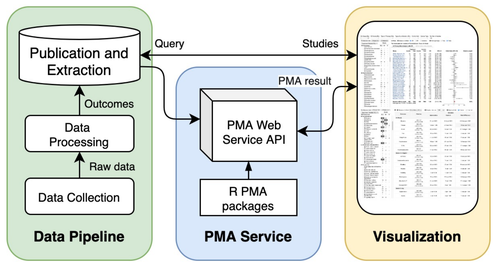
Due to the complexity of the PMA needs from the clinical question, we built a prototype system to validate the concepts and collect feedbacks based on an ongoing PMA project. The following domain goals are identified as the initial step to start our visual design and development:

T.1 *How to best present safety and toxicity results for a given outcome from a particular drug?*
T.2 *How to best summarize the evidence across a range of outcomes to assess its overall performance*?

Then, we identified the following design requirements:

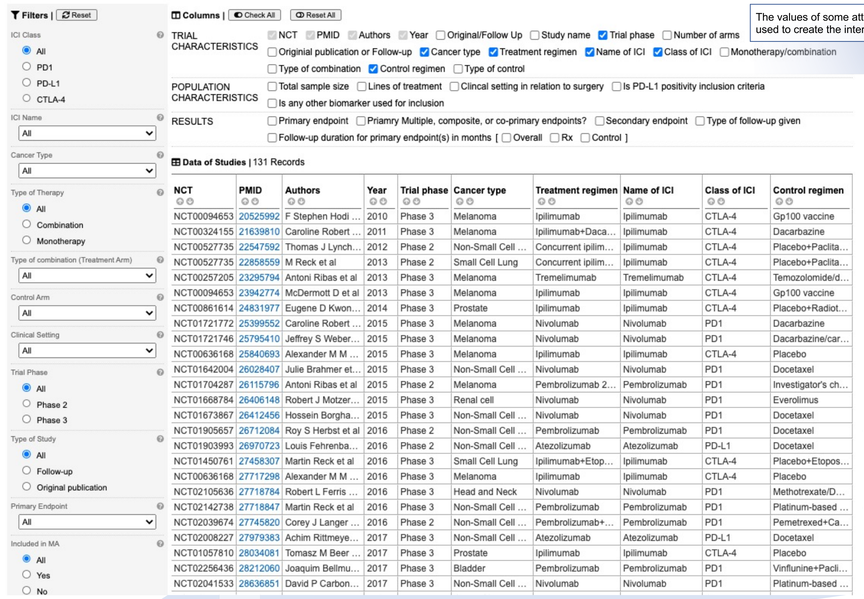
R.1 *Interactive exploration.*
R.2 *Exploration of different settings.*

As shown in the following figure, our proposed system consists of three major modules: the data pipeline, the PMA service, and the visualization frontend.



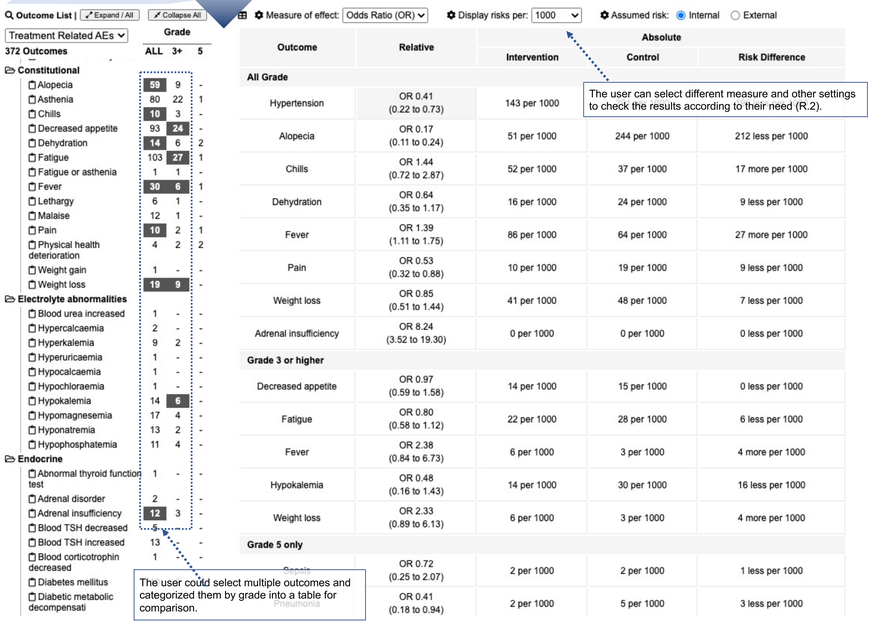
Interactivity Designs for Visual Exploration of Pairwise Meta-Analysis Results

The system provides an interactive table to show all studies included in the meta-analysis with detailed attributes, such as cancer type, treatment regimen, and control regimen.



The values of some attributes are used to create the interactive filters

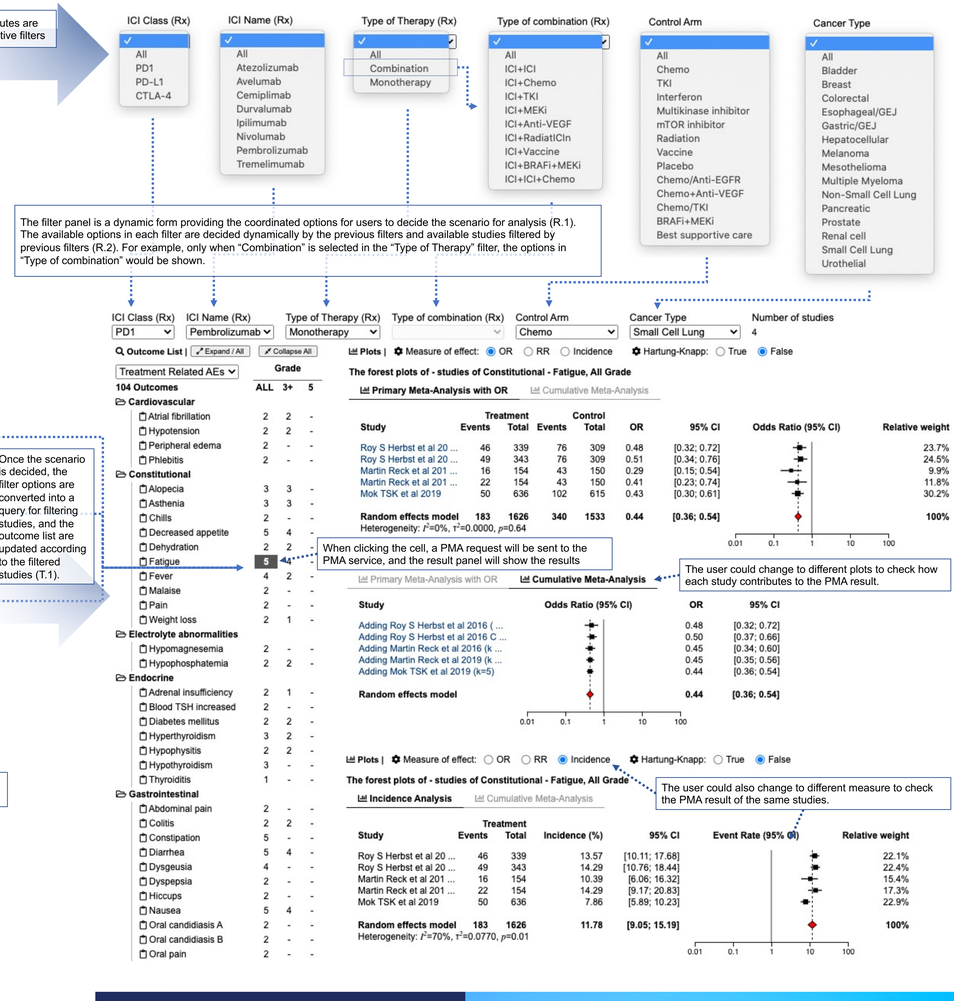
In addition to decide a specific scenario for analysis, the system provides an outcome comparison mode to support multi-outcome comparison in one view. All of the available studies in each outcome are used to create a summary of findings table to compare the overall performance (T.2).



The user could select multiple outcomes and categorized them by grade into a table for comparison.

The user can select different measure and other settings to check the results according to their need (R.2).

To demonstrate the visual and interactive designs, a public version is released based on an ongoing project "Toxicity of Immune Checkpoint Inhibitor" : https://iotox.living-evidence.com/



Once the scenario is decided, the filter options are converted into a query for filtering studies, and the outcome list are updated according to the filtered studies (T.1).

Future Work

Our domain experts appreciated the interactive designs and were able to effectively use the system to explore the PMA results. While the existing features provide enough details to see check the outcomes and assess the performance, limited support is available for figuring out the how are the changes when new studies are imported. In addition, the results should be further summarized for shared decision making in clinical practice.

Since our system is still in early stage, and there are still many MA results to be included in the system, we will work on improving the visual designs and developing the features for further use of the MA results in both clinical research and practice.