

NTKApp

NeuroToolKit (NTK) App User Guide

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1 Introduction

1.1 Scope and Purpose

The NeuroToolKitApp is a powerful, cloud based, fully integrated analytics platform that helps ease the process and maximize interpretability and insight from neurologically relevant immunoassay data while providing a unified cloud-based platform for stakeholders. The NTKapp consists of three interlinked apps. This allows users to upload and curate, analyze, and compare biomarker datasets and results from all over the world in a few simple clicks. Thanks to the NTKApp's in-built virtual machine, we offer the option of importing, shaping, and running your own statistical analysis pipeline which can later be shared within the NTK community.

The NTKapp is the new Neurology field tool to exchange new ideas and encourage valuable research and industry partnerships to accelerate biomarker discovery and development in the Neurology space.

The ADDI NTK Data Hackathon event is intended to bring together researchers, biostatisticians, data scientists, and other experts interested in improving our understanding of the early indicators of neurological disease using the NTKApp and other robust analysis tools available on the AD Workbench, the cloud-based data sharing platform created by the Alzheimer's Disease Data Initiative.

This guide provides information on how to curate and analyze data, as well how to share results.

2 NTKCuration App

The NTKCuration App module offers user-friendly data upload. Your biomarker data needs quality control and standardization before being used in the NTKAnalysis App. Using the NTKCuration App is cost and time efficient because this automated data standardization process minimizes human error and allows comparability across data sets.

This section covers the use cases for the NTKCuration App. **Click through the list below to jump to a subsection.**

- [Load dataset](#)
- [View the loaded dataset columns & search for columns](#)
- [Map your variables](#)
- [Add own variables and categories](#)
- [Save and Load mapping file](#)
- [View and save curated dataset](#)
- [Data dictionary](#)

2.1 Load dataset

You can use your dataset from your workspace.

1. Click the *Load Dataset* button
2. Select your dataset file from the file explorer (you can use breadcrumbs navigation through folders)
3. Click the *Load* button
4. Your dataset file was loaded in the NTKCuration App and it is ready for curation

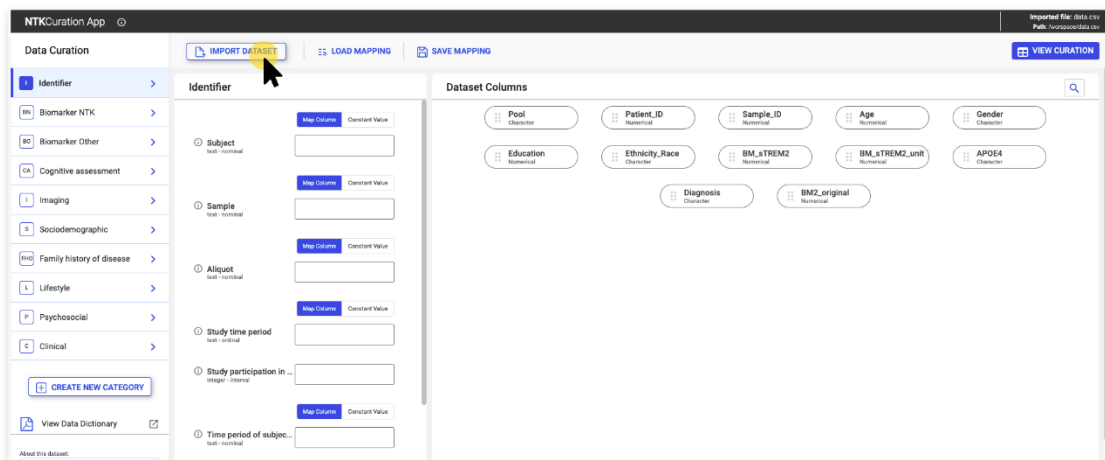


Fig. 2-1 NTKCuration App: Load Dataset – Main screen

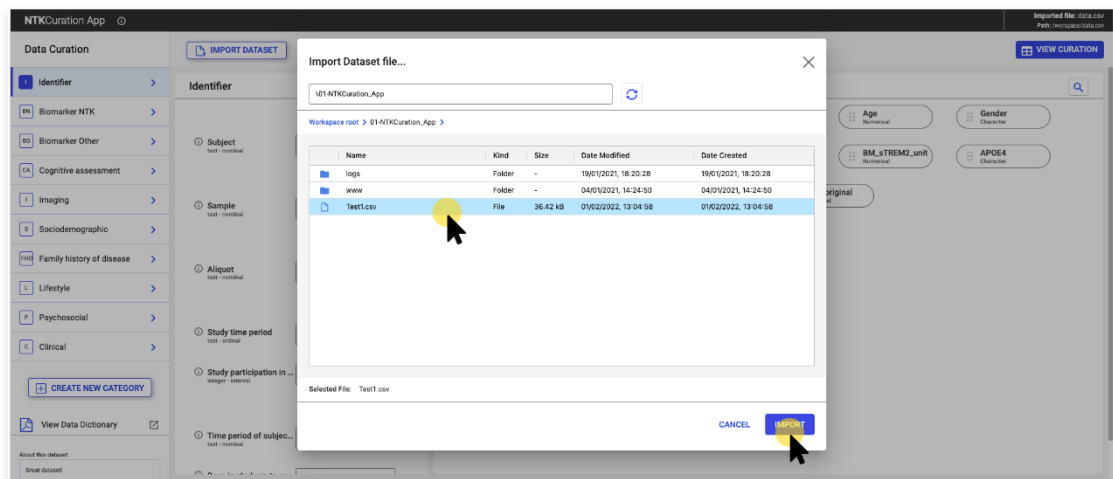


Fig. 2-2 NTKCuration App: Load dataset – Dialog file explorer

NOTES:

1. Dataset files **MUST** be in .csv format, otherwise they will not be displayed in the dialog file explorer.
2. After a mapping session (see [Map variables](#) and [View and save curated dataset](#) sections), load a new dataset to perform curation. Please make sure that you have saved the mapping before loading a new dataset.

2.2 View the loaded dataset columns and search for columns

After successfully loading a dataset, dataset columns will be displayed on the right side of the screen, in *chips*. A chip displays the title of the column and the type of data contained in your column (numerical, character etc). **Only unmapped variables** are displayed in the dataset column section. If a dataset has a lot of columns, you can search for a column using the *search function*.



Fig. 2-3 NTKCuration App: Dataset Column display (chip)

2.2.1 Search for a column

1. Click on the *search field*
2. Input the name of the column to be displayed
3. Press the *enter* button on your keyboard
4. Only the columns matching your search criteria are displayed

NOTE: Delete the text in the search field and press *enter* for all your loaded columns to be displayed again in the *Dataset Columns* section

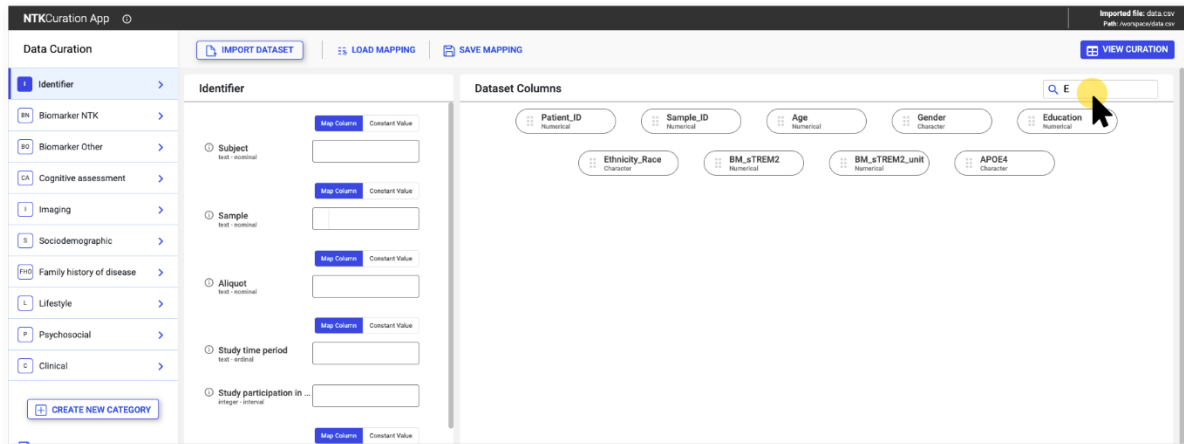


Fig. 2-4 NTKCuration App: Search for a column

2.2.2 View values of a specific dataset column

1. Double click on a *chip* in the dataset columns section
2. Display all the values in a dataset column
3. If the values in the column are numeric, then the following info is displayed:
 - a. \bar{x}
 - b. min value
 - c. max value
 - d. standard deviation (SD)
 - e. number of missing values
 - f. total number of values
4. For other types of data, the following info is displayed:
 - a. number of missing values
 - b. total number of values
 - c. number of unique values

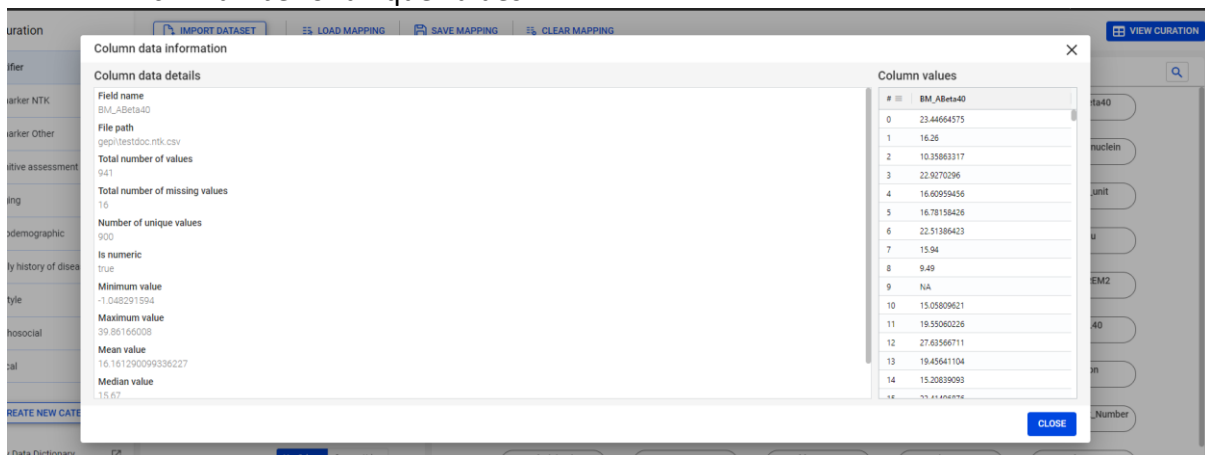


Fig. 2-5 View values for a specific column in the dataset

2.3 Map variables

Variables are displayed on the left side of the screen and are grouped into categories (Identifier, Cognitive Assessment, Sociodemographic etc). Each category and variable are predefined in the *NTK Data Dictionary*, which is loaded when the application is launched. You can also add your own variables and categories and extend the data dictionary (see section 2.4 - [Add own variables and categories](#)).

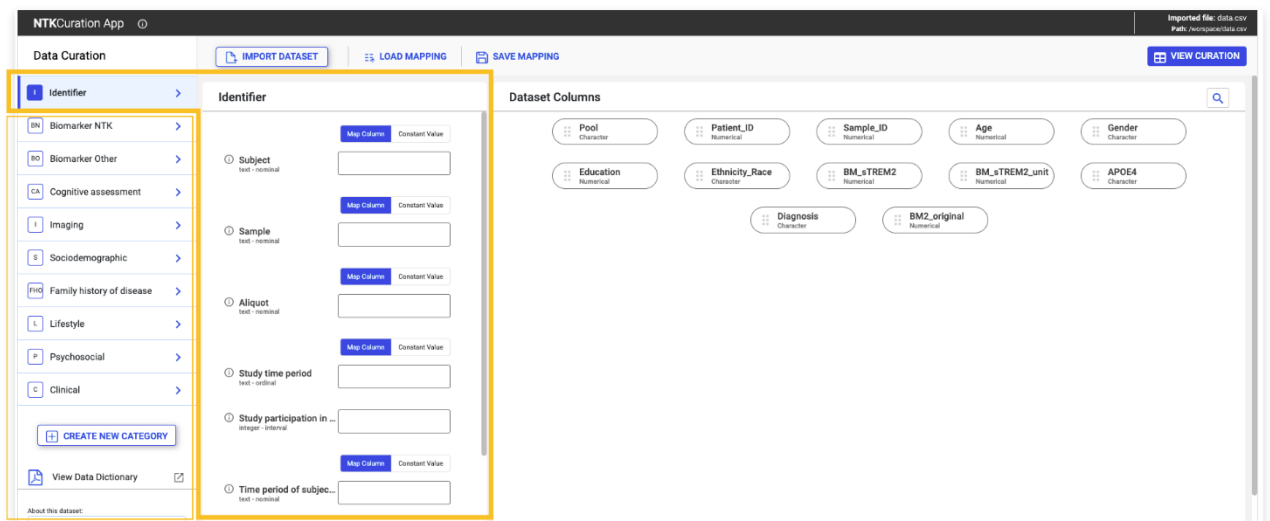


Fig. 2-6 NTKCuration App: Variables and categories - Main screen

Each variable displays the type of data supported by the dictionary in use and the variable description (hover over ⓘ displayed on the left side of each variable to see its description). Dataset columns can be mapped to the relevant variables.

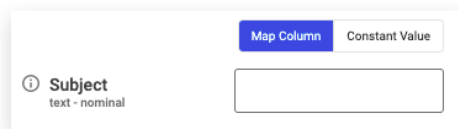


Fig. 2-7 NTKCuration App: Variable view

NOTE: A dataset file MUST be previously loaded in the app in order to map your variables to the data dictionary

2.3.1 Map variables

Variables can be mapped to the data dictionary in two ways:

1. Mapping variable from drop down list

- a. Click on the variable field where you want to map your dataset column
- b. Select the dataset column title from the drop down (you can also type the column name in the field and your variable will be filtered out)
- c. The selected variable is placed in the field and displayed as a chip and is no longer displayed in the dataset column section
- d. Click through categories and repeat the action for all the variables you wish to map to the dictionary

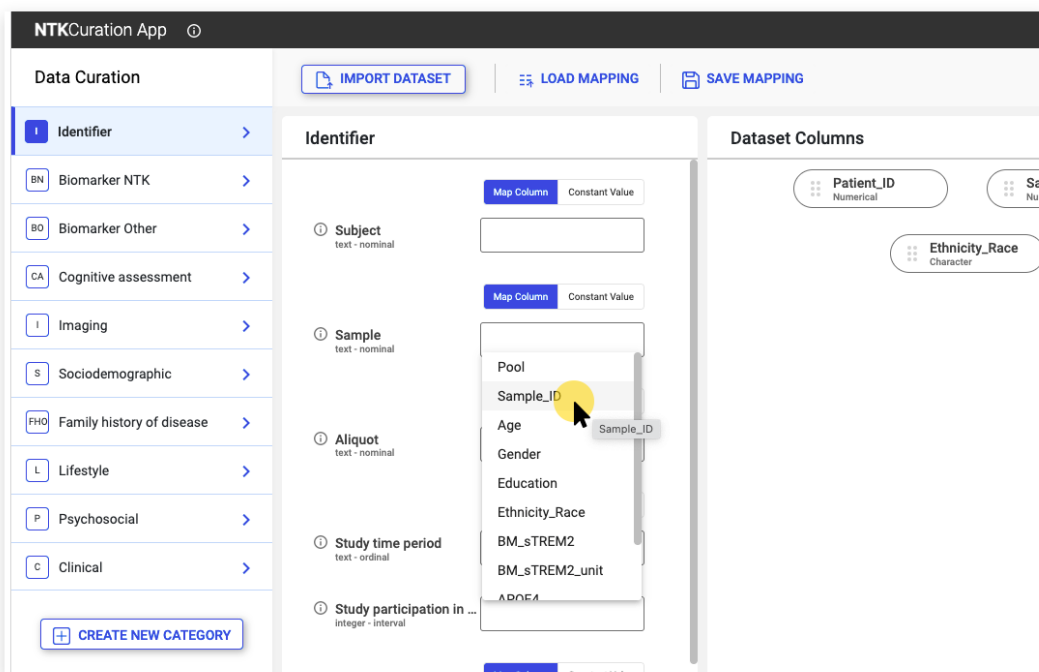


Fig. 2-8 NTKCuration App: Mapping variable using drop-down list

2. Drag and drop the dataset columns in the variable fields

- a. Drag a dataset column and drop it in a variable field
- b. The dropped column is displayed in the variable field and is no longer displayed in the dataset column section
- c. Click through categories and repeat the action for all the variables you wish to map to the dictionary

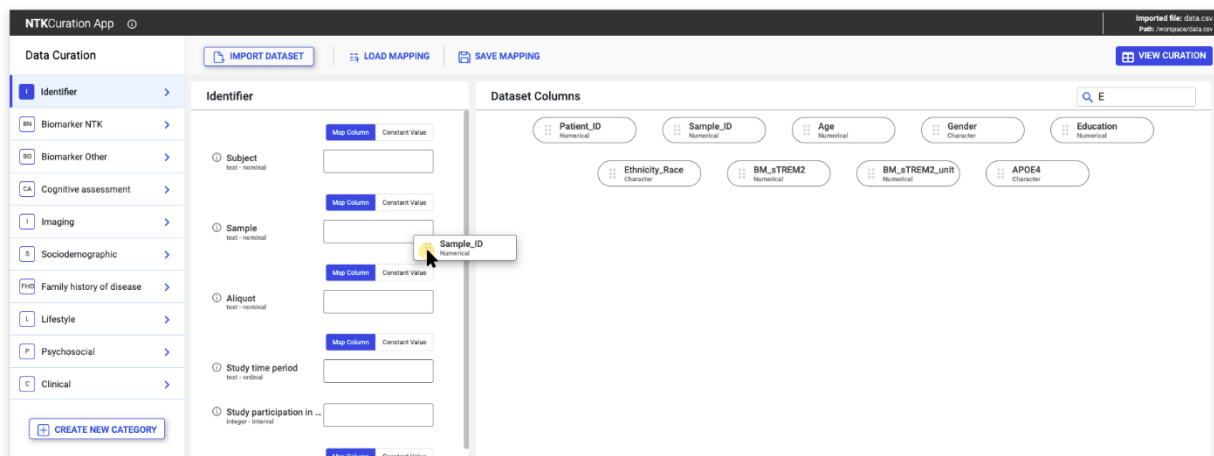
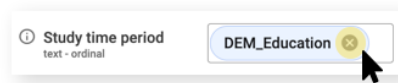


Fig. 2-9 NTKCuration App: Mapping variable using drag & drop function

NOTES:

1. Only one dataset file can be loaded when mapping variables to the dictionary fields.
2. Only one variable can be mapped to one dictionary field.
3. Dragging and dropping a variable over an already mapped one will take its place, removing the previously mapped variable and place it back to the *Dataset Columns* section.

4. A mapped variable can be unmapped by clicking the “x” (close) button on the chip placed in the variable field. Removing it from the variable field will place it back to the *Dataset Columns* section.



2.3.2 Add a constant value

A variable can be filled in with a constant value.

1. Click the *Constant Value* toggle on top of the variable field
2. Type in the text which will be the constant value of the variable
3. Repeat the action for the variables you want to fill in with a constant value

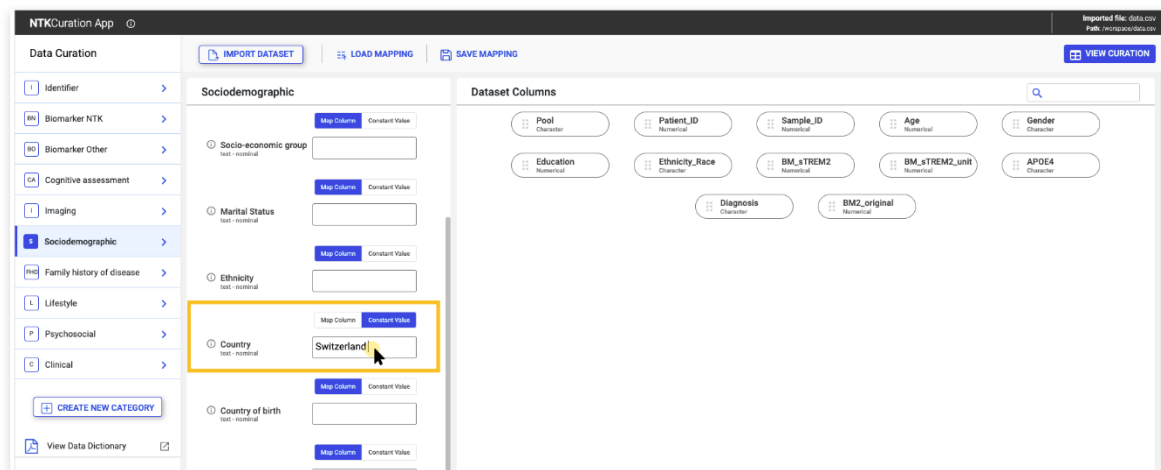


Fig. 2-10 NTKCuration App: Constant value

NOTE: Some variables cannot be filled in with a constant value. See [Fig. 2-9 Constant value](#) for screen reference

2.3.3 Map different types of variables

Some variables have multiple allowed values (e.g. *Gender* variable). You can choose how the values in your dataset are represented in the NTKCuration App. For example, if females in your clinical study are labeled with “1” or “F”, you can match the “1” or “F” value to the “Female” variable value field.

1. Map variables using drop-down or drag and drop function (see [Map variables](#) section for reference)
2. If a variable has multiple allowed values, additional fields for that variable are displayed
3. Click on a field to set a value for that variable
4. A drop-down list is displayed with the values identified for that column of your dataset file

5. Click on the value which matches the data dictionary label to be mapped to your variable
6. Repeat the action for all the values applicable to your variable

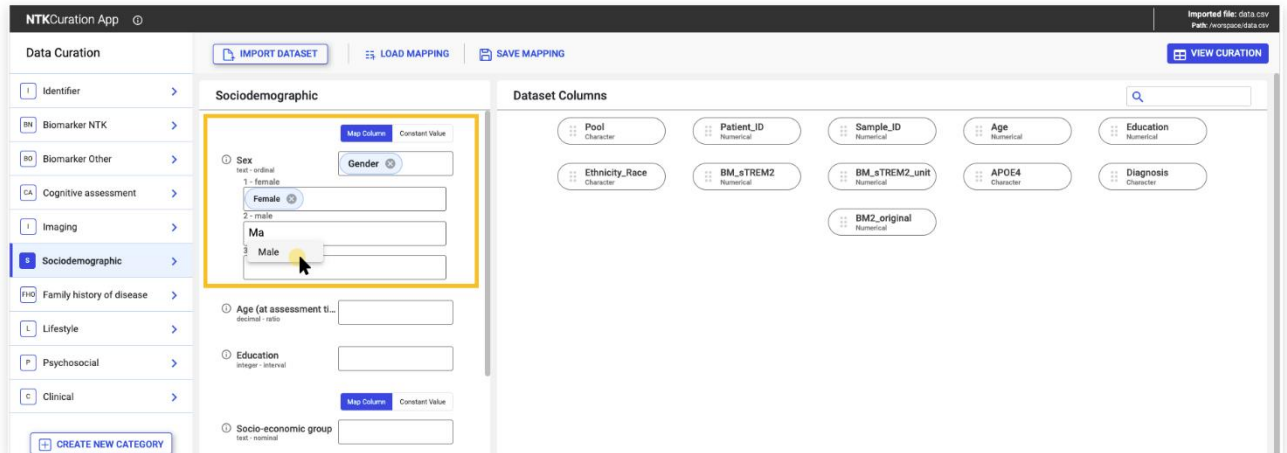


Fig. 2-11 NTKCuration App: Different types of variables

2.3.4 Clear mapping

When mapping variables from a different dataset, clear the previous mapping.

1. Click the *Clear Mapping* button
2. All your previously mapped variables are moved back to the *Dataset Columns* section
3. Load a new dataset file
4. The newly imported columns are displayed in the *Dataset Columns* section
5. Map the newly imported columns to variable fields (see [Map variables](#) section)

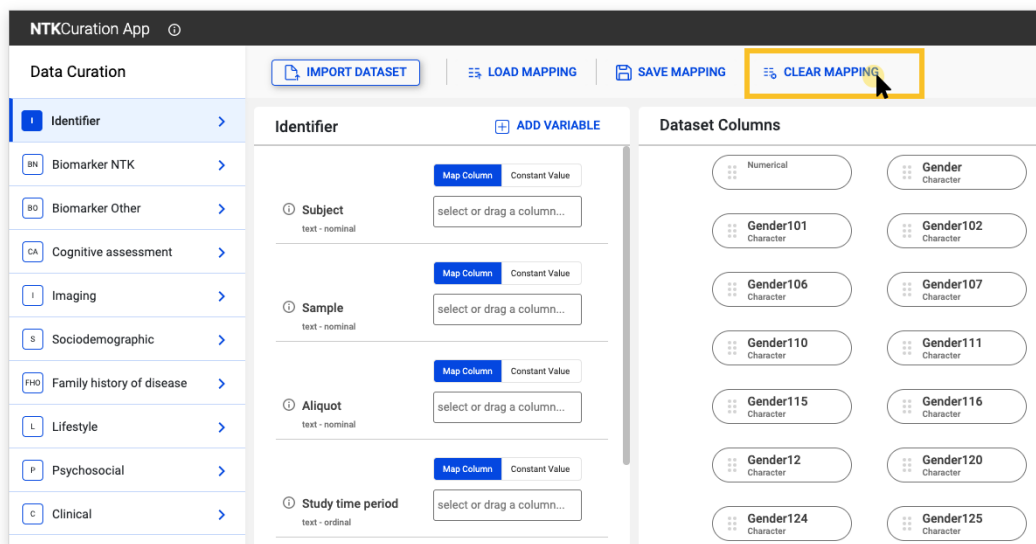


Fig. 2-12 NTKCuration App: Clear mapping

2.4 Add variables and categories

You can add your own variables in each existing category or create other categories that are relevant to the dataset.

2.4.1 Add variables

1. Click the *Add Own Variables* button
2. A dialog window is displayed with the following fields:
 - a. Variable Name
 - b. Variable Type (time, integer, decimal etc.)
 - c. Attribute Type (nominal, ordinal, interval or ratio)
 - d. Units
 - e. Levels **NOTE: You can mark a variable as a factor with automatically discovered levels based on the mapped values**
 - f. Levels texts
 - g. Checkboxes for:
 - i. Is the variable required?
 - ii. Are N/As allowed?
 - iii. Time attribute
3. Add the variable name. **NOTE: Variable names must be unique**
4. Select the variable type from the drop-down list
5. Select the variable attribute
6. Type the units in which the variable is measured
7. Type the levels for the variable. **NOTE: Separate the levels with a comma, without spacing (e.g. 0,1,2,3).**
8. Check any applicable boxes for:
 - i. Is the variable required?
 - ii. Are N/As allowed?
 - iii. Time attribute
9. Click the *Add* button in the dialog window
10. The variable is displayed in the UI
11. Map the variable (see [Map variables](#) section for reference) from the dataset columns
12. Repeat the action for each new variable

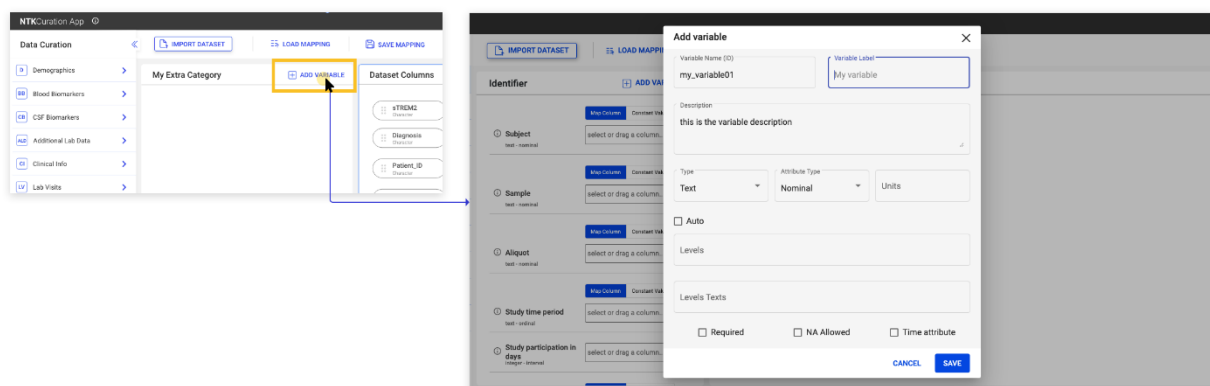


Fig. 2-13 NTKCuration App: Add own variable

NOTES:

1. A new variable that is created but not mapped will also be saved in the mapping file. (section [2.5.1 -Save mapping](#), explains how to save a mapping file).
2. If N/A values are not allowed, but the dataset column contains N/A values, curation can not be performed and the dataset must be adjusted in order to perform curation. This information is also covered by the [Save curated dataset](#) section

3. Click on the “X” button to delete a new variable.

2.4.2 Create new categories

1. Click the *Create New Category* button in the Data Dictionary contextual menu
2. Enter category name. **NOTE: Category names must be unique**
3. Add your own variable(s) in the new category (see [Add own variables](#) section for reference)
4. Map the variables (see [Map variables](#) section for reference)
5. Repeat the action for each new category.

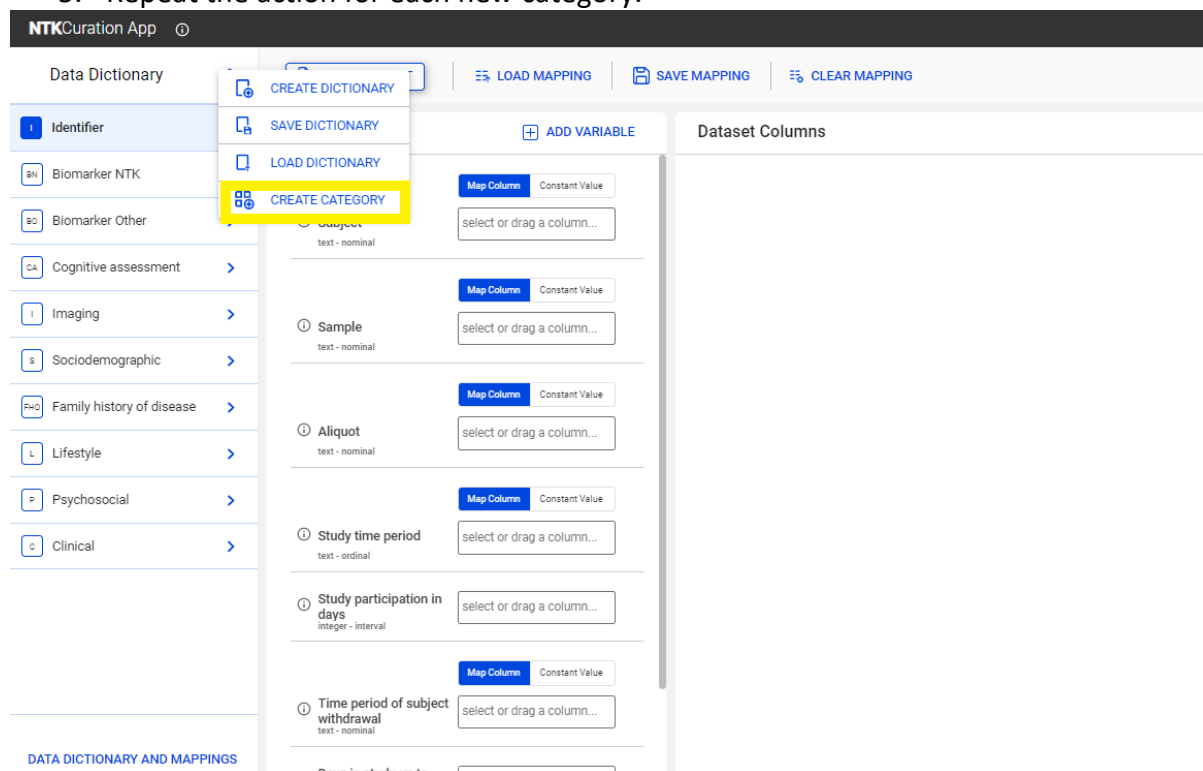



Fig. 2-14 NTKCuration App: Create new category

NOTE: You can *Rename* or *Delete* a new category. Hover over the right side of the category name, click the “More” button  and select your option

2.5 Save and Load mapping file

After mapping the variables, save the mapping file in your Workspace. The mapping file may be loaded later.

2.5.1 Save mapping

1. Click the *Save Mapping* button
2. A dialog file explorer opens
3. Select a folder to save the mapping file
 - a. Create a new folder
 - b. Use breadcrumb navigation to select the folder to save the mapping file
4. Name the mapping file

5. Click the **Save** button. **NOTE: A mapping file can be overwritten with a more recent one or saved as a new document**
6. The mapping file is saved in the specified location in your workspace

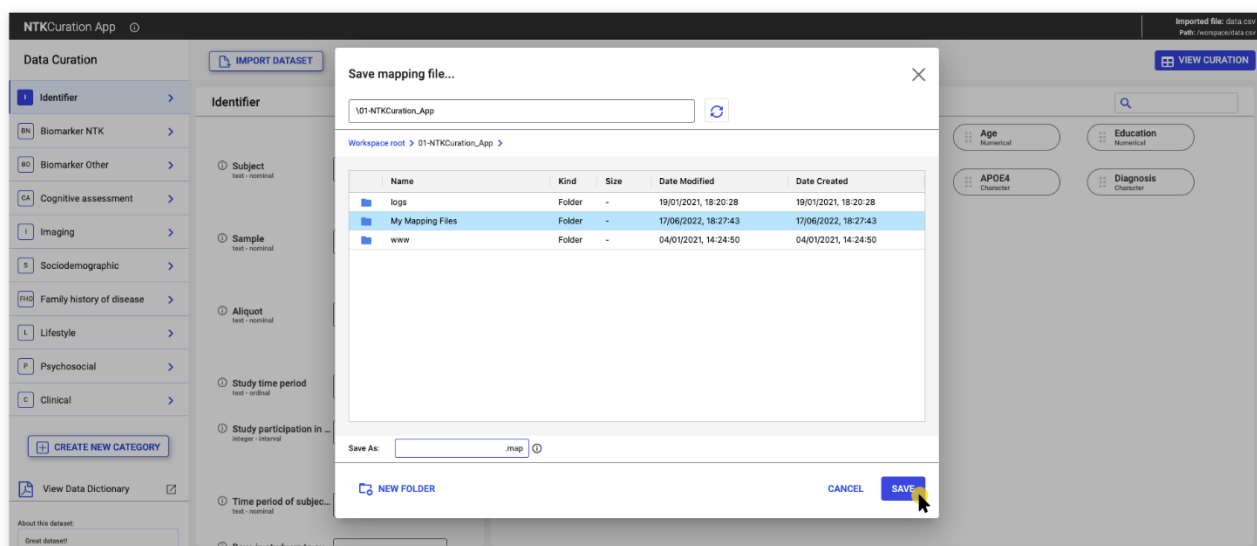


Fig. 2-15 NTKCuration App: Save mapping file

2.5.2 Load mapping

1. Click the **Load Mapping** button. **NOTES: A dataset file must be previously loaded in order to load a mapping file. Only one dataset file can be loaded for loading a mapping file**
2. A dialog file explorer is displayed
3. Select the mapping file
 - a. Use breadcrumbs navigation to go through the folders
4. Click the **Load** button
5. The previously mapped file is loaded in the application

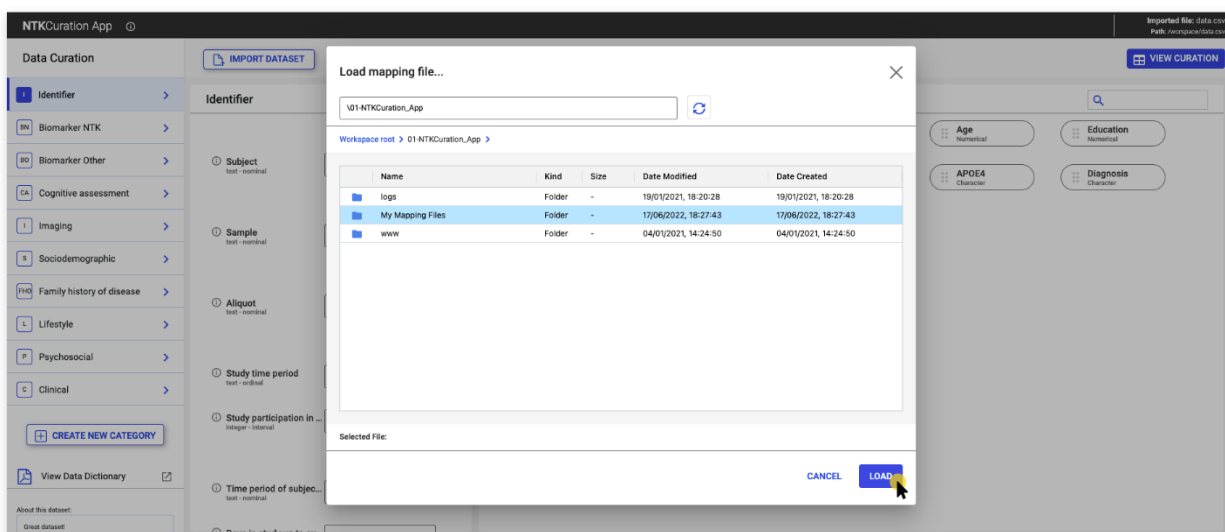


Fig. 2-16 NTKCuration App: Load mapping file

Notifications and errors in loading a mapping file:

1. A mapping file that contains some mapped variables which do not exist as columns in the loaded dataset cannot be loaded. Ensure that the loaded dataset has mapped variables.
2. A mapping file that is loaded with variables that were not included in the data dictionary but do exist as columns in the dataset file will automatically have the missing variables added to the dictionary.

2.6 View and save curated dataset

After the variables are mapped to the data dictionary, the curated dataset can be viewed and saved to your workspace.

2.6.1 View curated dataset

The curated dataset is displayed in a table. The mapped variables are renamed according to the data dictionary in use. The newly added variables are displayed in extra columns. You can preview, filter and sort the data before you save your curated dataset.

1. Click the *View Curation* button
2. The curated dataset is displayed in a table
 - a. Filter data in each column
 - b. Sort data in each column (ascending or descending)
 - c. Adjust column widths

#	ID_sample	ID_sample_siquot	ID_visit	ID_time_from_baseline
1	57	2	1	
2	68	2	2	
3	73	2	3	NA
4	78	2	4	NA
5	62	1	5	NA
6	55	2	6	NA
7	75	2	7	NA
8	66	1	8	NA
9	68	1	9	NA
10	72	2	10	NA
11	71	2	11	NA
12	61	2	12	NA
13	78	1	13	NA

Fig. 2-17 NTKCuration App: View curated dataset

NOTE: Only mapped variables will be displayed in the curated dataset table

2.6.2 Save curated dataset

1. Click the *Save Curation* button
2. Select the file location for the curated dataset
 - a. Use breadcrumbs navigation to select your folder
 - b. Create a new folder to save the curated dataset
3. Name your curated dataset file
4. Click the *Save* button
5. Your curated dataset file is saved in the workspace

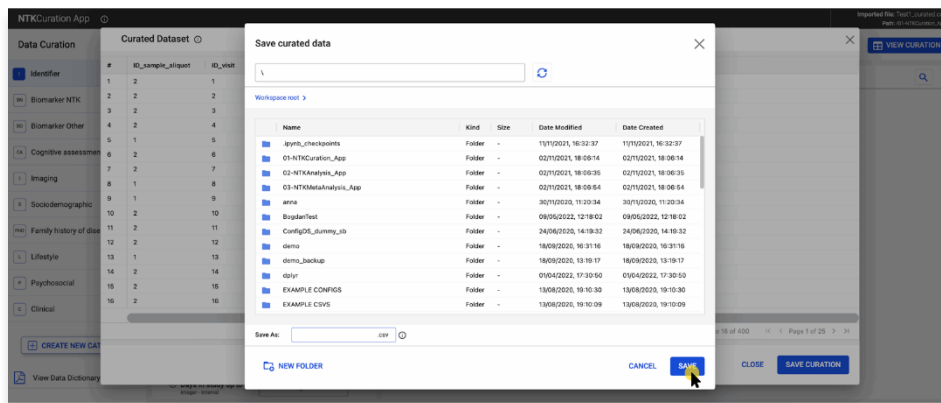


Fig. 2-18 NTKCuration App: Save curated dataset

NOTE: When a curated dataset is saved, the mapping file and the new dictionary are also automatically saved in the same folder. This dictionary contains the standard NTK Dictionary variables and the newly added variables (if any).

2.7 Data dictionary

A data dictionary is a compendium of variables, their types, allowed values, units, and levels. The NTK Data dictionary is automatically loaded when launching the NTKCuration App and can be viewed and saved (see [Fig. 2-19 NTKCuration App: View and Save Dictionary](#)). It encompasses the categories and their inherent variables, as well as the type of data allowed for a specific variable and the variable units. Some variables have multiple allowed values (e.g., gender), which are also defined in the NTK Data Dictionary.

When you save your curated dataset with a newly created variable, the NTK Data Dictionary is automatically extended with your custom variables and saved in the specified location, along with the mapping file (See [Save curated dataset](#) section). This helps you when sharing your results with your partners, for them to understand how your data is structured and how to perform their analyses in accordance with your variable dictionary.

2.7.1 Dictionary and Mappings

The NTK Data Dictionary used for creating the variables and categories can be viewed and saved locally.

1. Click the *Dictionary and Mappings* section on the bottom-left side of the screen
2. A window is displayed with the standard dictionary categories, variable names, variable labels, descriptions, variable types and attributes, units, levels, level texts, if the variable is required, if there are N/As allowed and if the variable has a time attribute, as well as the mapped columns to variable fields.
3. Filter and/or sort columns
4. Click the *Save* button to save NTK Data Dictionary as .csv locally.



Fig. 2-19 NTKCuration App: View and Save Dictionary and Mappings as csv file

2.7.2 Create Dictionary

You can create your own Data Dictionary in this section.

1. Click on the *Create Dictionary* button in the Data Dictionary contextual menu
2. Make sure that your previously used dictionary and mappings are saved
3. All categories and variables will be removed from the UI
4. You can create new categories and variables, load another dataset file and mapping file and map your dataset to your custom dictionary.

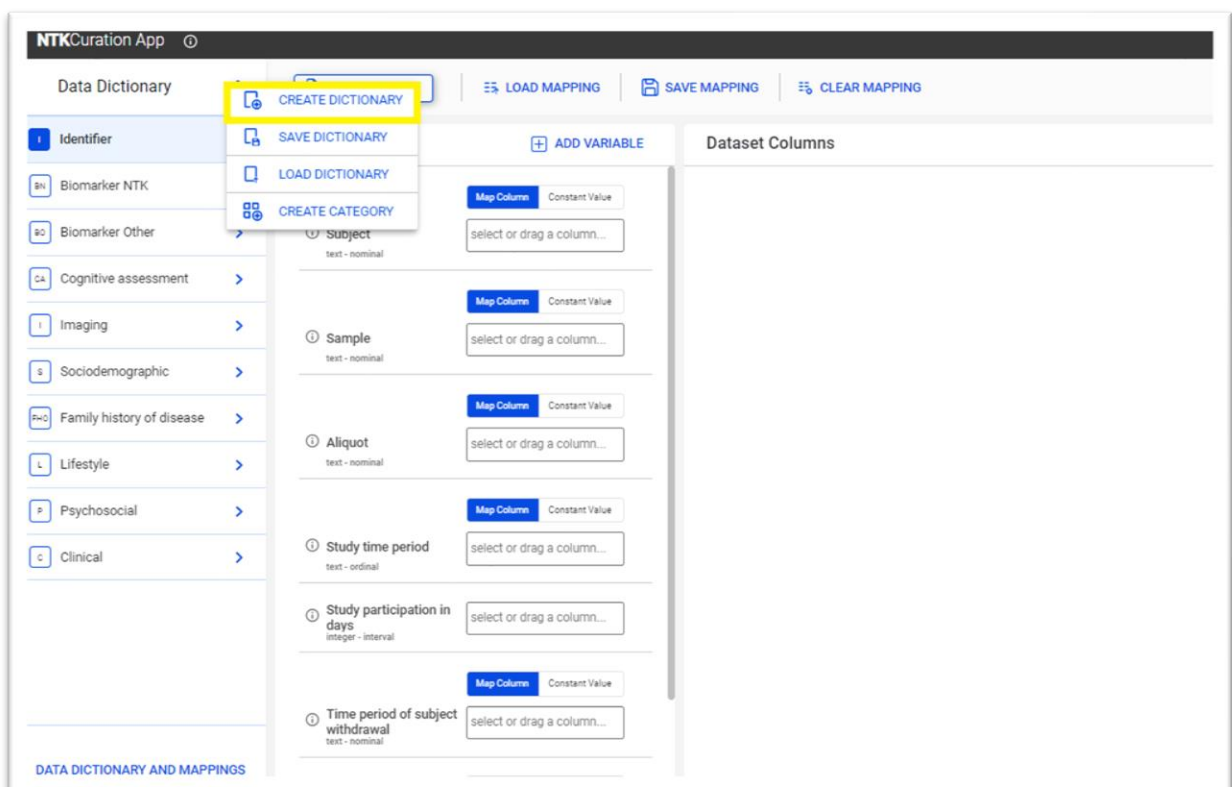


Fig. 2-20 NTKCuration App: Create Dictionary

2.7.3 Save Dictionary

In this step you can save your Data Dictionary to load it later in your journey

1. Click the *Save Dictionary* button in the Data Dictionary contextual menu
2. Select the location in which you want to save it

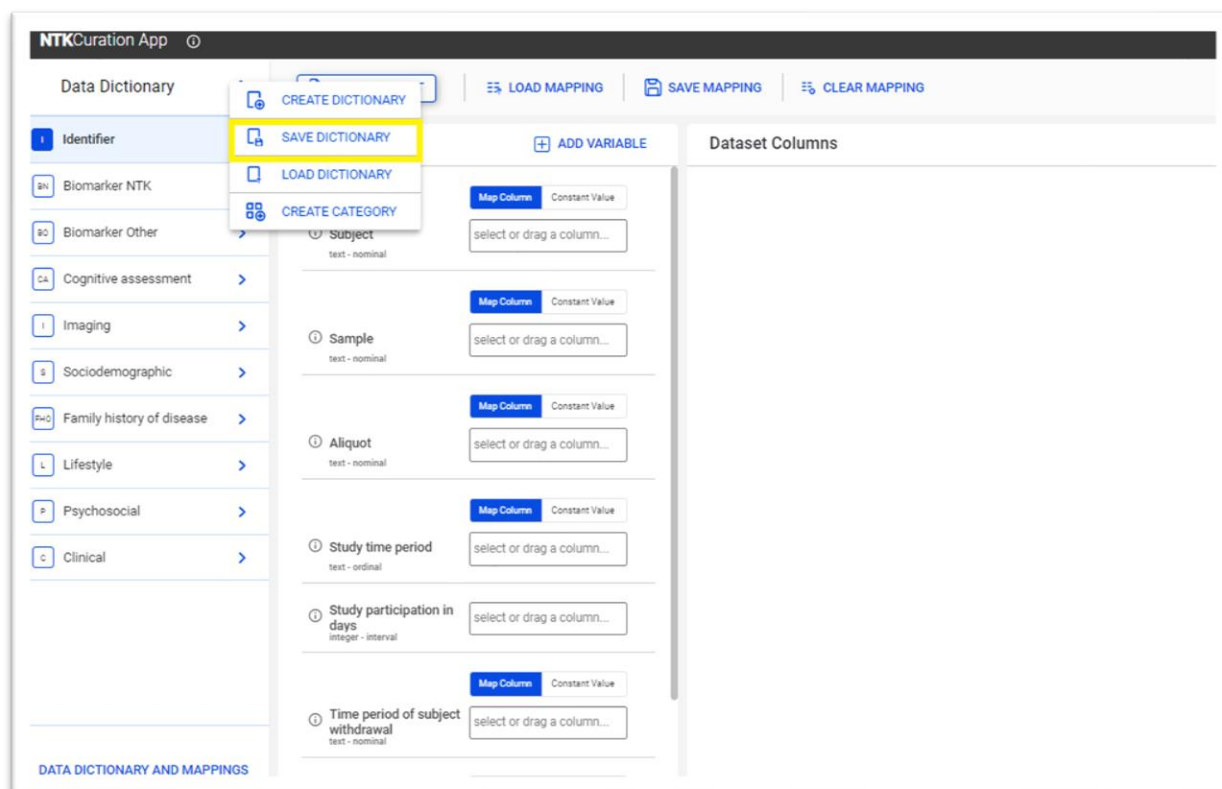


Fig. 2-21 NTKCuration App: Save Dictionary

NOTE: If you forgot to save your data dictionary but you have saved your curated dataset (See [Save curated dataset](#) for reference), your dictionary in use is automatically saved in the same file location and with the same filename as your curated dataset. You can recover your Data Dictionary from there.

2.7.4 Load Dictionary

A previously saved dictionary (.dict) file can be loaded in Curation App from this section. All saved variables and categories will be loaded.

1. Click the *Load Dictionary* button in the Data Dictionary contextual menu
2. Select the Data Dictionary file you want to load from the workspace
3. Click the *Load* button on dialog file explorer
4. Your previously saved Data Dictionary is loaded in Curation App and can be used for mapping.

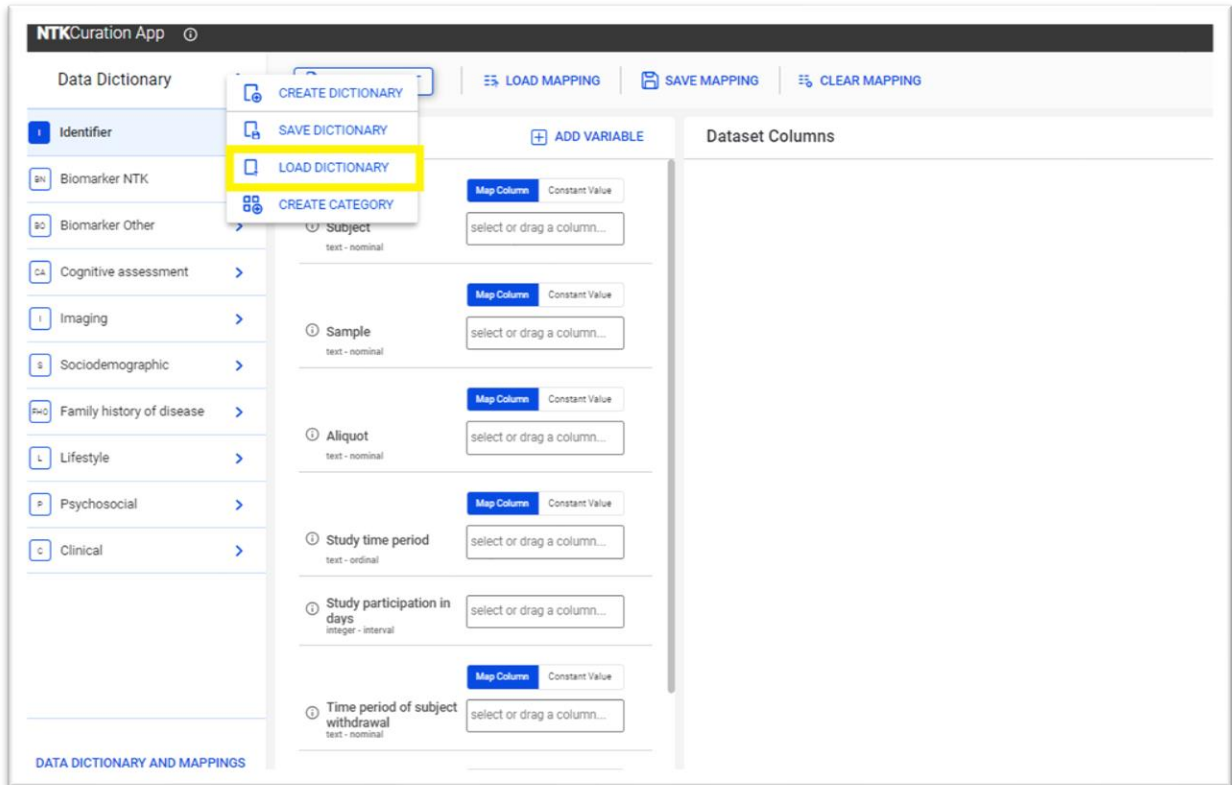


Fig. 2-22 NTKCuration App: Load Dictionary

3 NTKAnalysis App

The NTKAnalysis App allows you to select from a suite of powerful descriptive statistics to gain immediate insight into your data. Outputs from these analyses are available in publication-quality tables and interpretable graphical *visualizations* which you can save locally. It provides interactive visualizations of descriptive statics, allowing users to document the findings in a *what you see is what you get* document.

This section provides the use cases for the NTKAnalysis App. **Click through the list below to jump to a subsection.**

- [Load Dataset](#)
- [Preview Data](#)
- [Load Analysis](#)
- [Text Editing](#)
- [Table of Contents](#)
- [Insert Analysis Modules](#)
- [Insert R Code](#)
- [Save Document](#)
- [Document Configuration](#)
- [Create New Document](#)
- [Side by Side Visualization](#)
- [Export Results](#)

3.1 Load Analysis

A previously saved analysis can be loaded in the NTK Document.

1. Click the *Load Analysis* button
2. A dialog file explorer opens
3. Select the analysis document
4. Click the *Select* button
5. The previously saved analysis file is loaded in the NTKAnalysis App
6. Analyze your data

The document will be displayed, and all the results stored in it are available. After loading a document, you can opt to load a different compatible dataset.

NOTE:

1. **If you want to load a new dataset on the NTK Document and apply the new dataset to the analyses already included in the NTK Document, click the *Load Dataset* button.**
2. **Compatible dataset: A dataset is considered compatible with a document if contains the same variables as the one used by the document**

3.2 Load Dataset

When loading a dataset, the curated data and the mapping file are loaded into the document. A noncurated dataset can be analyzed, but we strongly advise to curate your dataset before performing any analysis. Curating your dataset beforehand harmonizes it, creates a custom

dictionary, and makes it easier to share your results in the NTKMeta-Analysis App. See [NTKCuration App](#) section for a step-by-step guide on curating a dataset.

1. Click the *Load Dataset* button
 2. Select the dataset file from the file explorer (use breadcrumbs to navigate through folders)
 3. Click the *Load* button
- Your dataset file was loaded in the NTKAnalysis App and ready to be analyzed

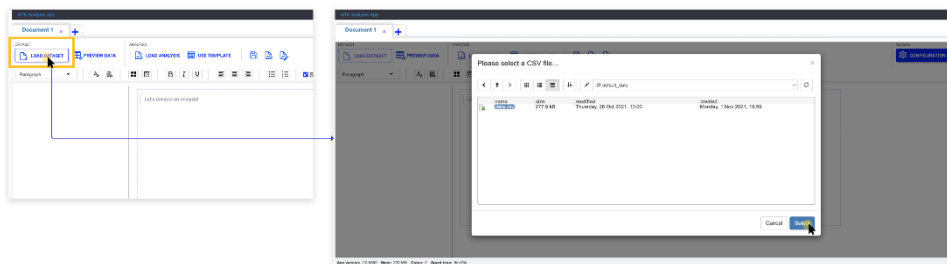


Fig. 3-1 NTKAnalysis App: Load Dataset

NOTES:

1. A demo dataset file is automatically loaded in the NTK document. The NTKAnalysis App functions can be explored without loading a dataset file. However, we advise you to perform analyses on your dataset

3.3 View Data

After loading your dataset, it can be previewed before being analyzed. The dataset is displayed in a table.

1. Click the *View Data* button
2. Your dataset is displayed in a table
 - a. Sort data in each column (ascending or descending)
 - b. Adjust column widths
 - c. Search for any value or text in the table

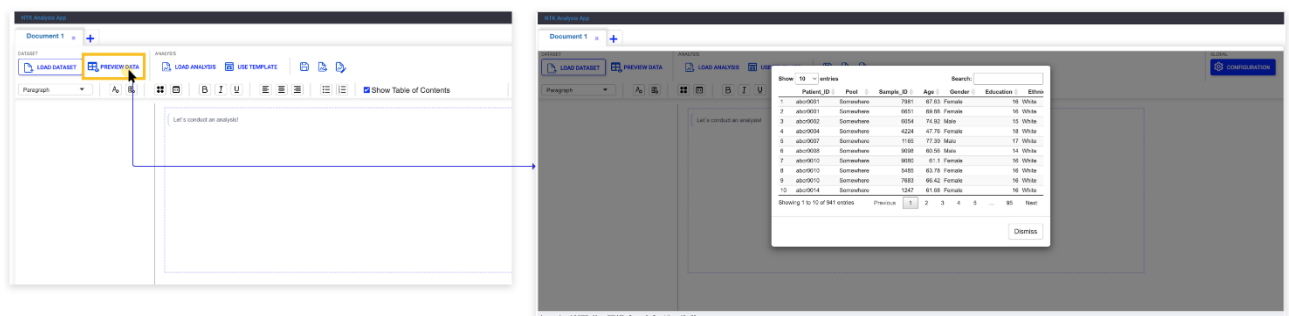


Fig. 3-2 NTKAnalysis App: View Dataset

NOTE: The NTKAnalysis App automatically loads a demo dataset. Follow the steps in the [Load Dataset](#) section to load your own dataset file.

3.4 Text Editing

Edit the NTK Document either from the document toolbar, or directly in-text.

3.4.1 Toolbar and in-text editing

You can set your headings, insert paragraphs, tables, align your content, format the text (**bold**, *italic* or underlined), create bulleted or numbered lists or insert images.

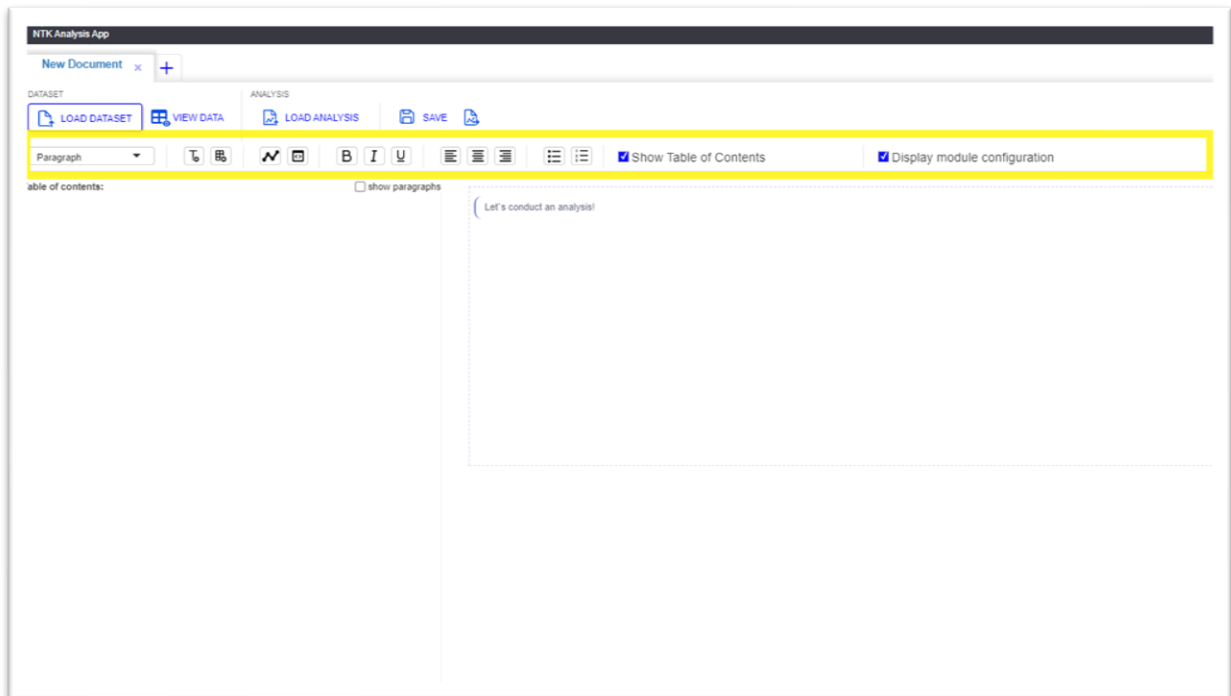


Fig. 3-3 NTKAnalysis App: Text editing from toolbar

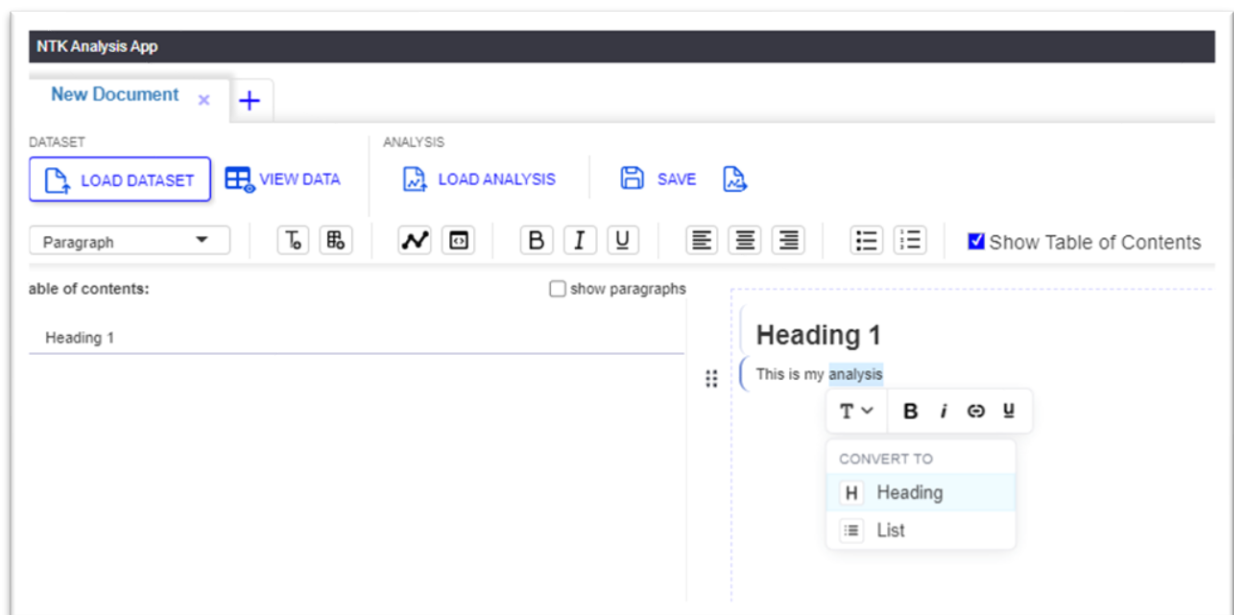



Fig. 3-4 NTKAnalysis App: In-text editing

3.4.2 Move and delete text

Use the stepper to move the content up and down in the document or click the “x” button to delete it. The options are displayed on hover, in the left side of the document.

3.4.2.1 Delete text/ document sections

1. Click anywhere on the text to delete
2. An options menu is displayed on the left side of the NTK Document
3. Click the  icon
4. Click the “X” (delete) button
5. The selected text is deleted from the NTK Document

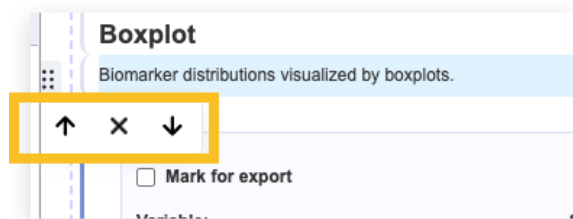


Fig. 3-5 NTKAnalysis App: Move and delete text

3.5 Table of Contents

The Table of Contents displays an overview of your document with sections of your text which are set as Headings (Heading 1 to Heading 6), Analysis module titles or R Codes. Tick the *Show Table of Contents* box to display it.

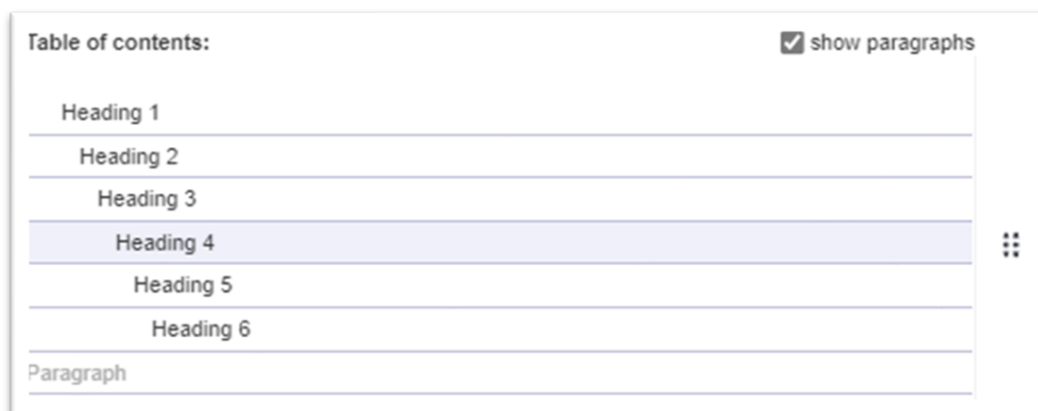


Fig. 3-6 NTKAnalysis App: Table of Contents

NOTE: Chapters can be reordered from the Table of Contents section. Tick the *View Paragraphs* box to show the paragraphs and reorder them in the ToC.

3.6 Insert Analysis Modules

3.6.1 Analysis Module Exploration

NTKAnalysis App has a series of built-in modules which can be used to analyze data. The modules are directly linked to the data dictionary and dataset in use and the variable types included must match the modules' functions.

3.6.2 Insert an analysis module

Analysis modules can be inserted either from the toolbar or directly in-text.

3.6.2.1 Insert an analysis module from the toolbar

1. Click the modules icon on the document toolbar
2. Select a module for data analysis
3. Select the variables to be included in the module
4. Select the display and other module-specific options. **NOTE: Each module has specific options to analyze and display data. Options are displayed on the right side of the module. See Fig. 3-10 NTKAnalysis App: Analysis module options for reference**
5. Apply filtering for your module (See the [Filter your module](#) section for reference)
6. Click the *Select* button to add the module in the NTK document
7. The analysis module is visible in the NTK document
8. Repeat this action for every module to be inserted in the NTK Document.

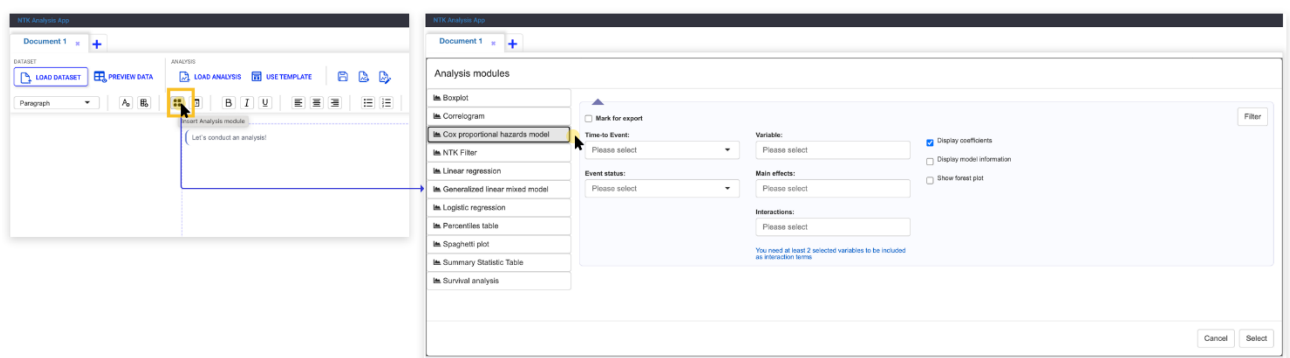


Fig. 3-7 NTKAnalysis App: Insert an analysis module from the toolbar

NOTE: Inserting an analysis module from the toolbar is the most efficient way to explore the analysis modules provided by the NTKApp before inserting them into the document. Only when clicking the *Select* button will an analysis module be inserted into the document.

3.6.2.2 Insert an analysis module in-text

3. Click the “+” icon displayed on hover on the left side of the document
4. A context menu is displayed
5. Click the *Add Analysis* icon
6. A list of available analysis modules is displayed
7. Select a module for data analysis
8. The module is **automatically** inserted in the document
9. Select the variables to be included in the module

10. Select the display and other module-specific options. **NOTE: Each module has specific options to analyze and display data. Options are displayed on the right side of the module. See Fig. 3-10 NTKAnalysis App: Analysis module options for reference**
11. Apply filtering for your module (See the [Filter the module](#) section for reference)
12. Repeat this action for every module to be inserted in the NTK Document.

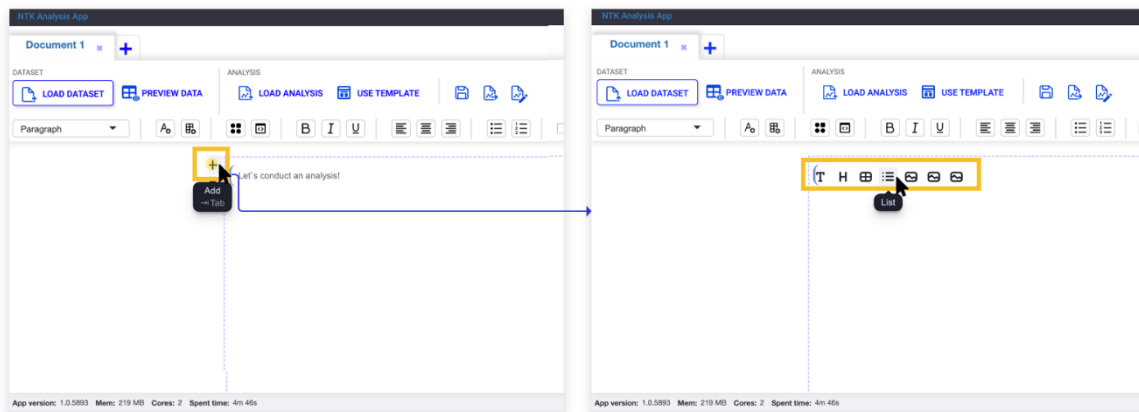


Fig. 3-8 NTKAnalysis App: Insert analysis modules in-text using the context menu

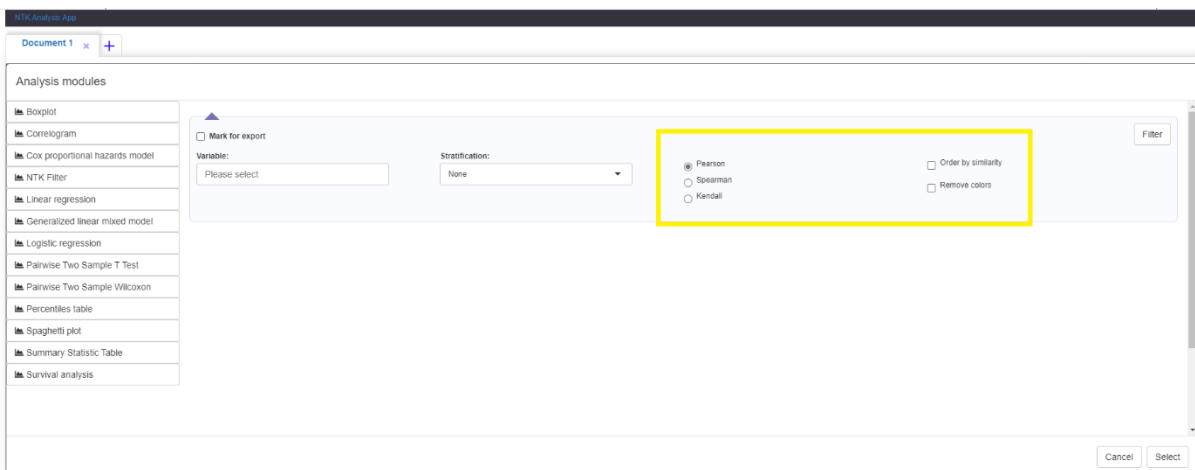


Fig. 3-9 NTKAnalysis App: Analysis module options

NOTE: A module can be deleted by clicking the “x” button displayed on the left-side of the NTK Document. See [Delete text/ document sections](#) for reference.

3.6.3 Filter the module

Each module has the option of filtering the data to be analyzed and displayed. When filtering data in the module, only the data set by the filters will be analyzed and displayed in the analysis module. E.g., if one of the variables inserted in the module is *Age*, in filtering, you can select to analyze data related to subject specific age ranges.

1. Click the *Filter* button on the far-right side of the analysis module
2. Select the variable to be filtered
3. Select the operator
4. Select values

5. Click *Select*
6. Your analysis module is automatically updated with the filtered data
7. Repeat this action for every filter

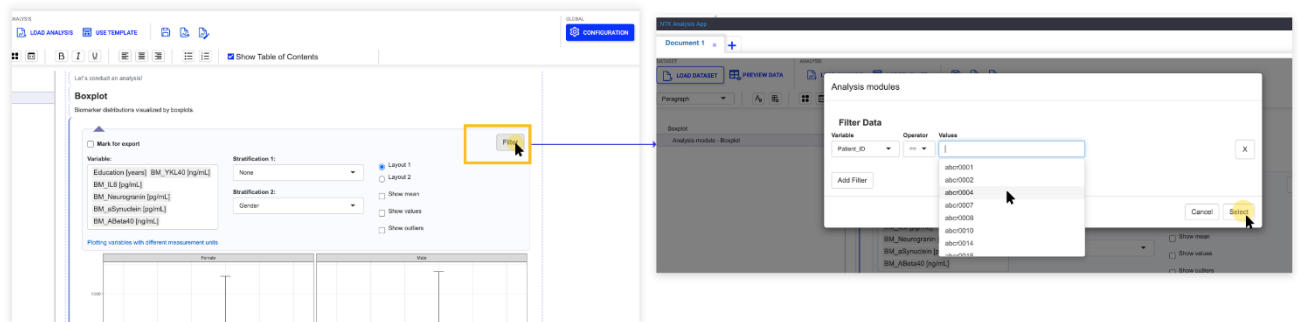


Fig. 3-10 NTKAnalysis App: Module filtering

NOTE: Click the “x” button to delete a filter and click *Select* again in the filter dialog, to apply. The deleted filter will be removed from the analysis module.

3.6.4 Display module configuration

Optionally, you can hide the configuration part for the analysis modules, displaying only a summary of the configuration.



Fig. 3-11 NTKAnalysis App: Display module configuration

3.7 Insert R Code

R Code can be inserted in the NTK Document to perform custom statistical computing or display custom graphics.

1. Click the *R Code* icon in the toolbar or in-text, from the **+** button displayed on the left side after clicking the anywhere in the document
2. Insert your R Code snippet
3. Click the **▶** (*Run*) button
4. Click the *Refresh analysis/Run all* button to apply the R Code snippet to the NTK Document

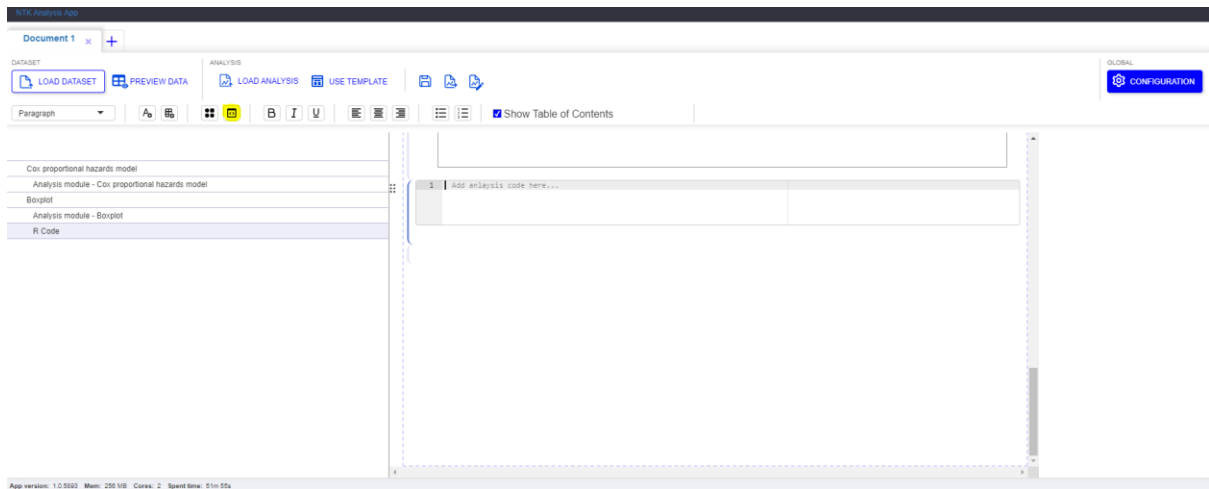


Fig. 3-12 NTKAnalysis App: Insert R Code

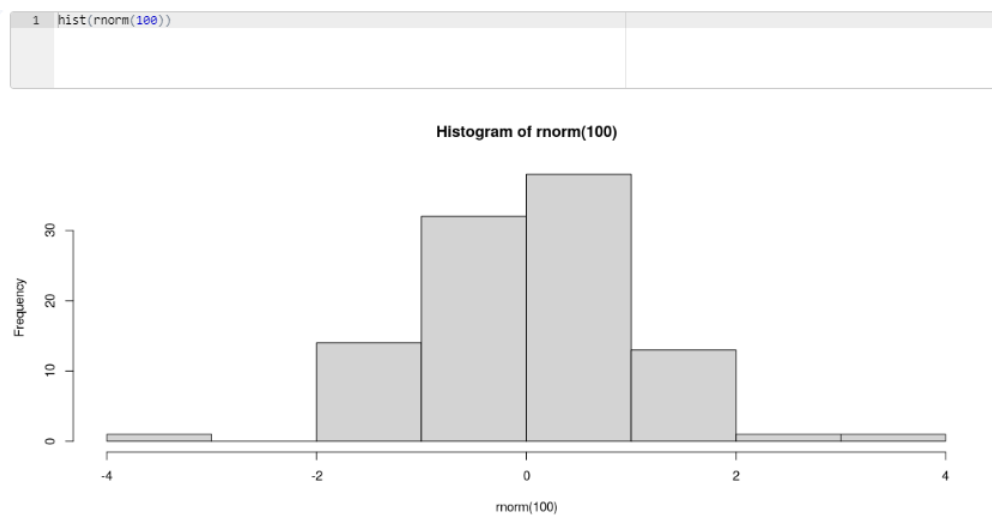


Fig. 3-13 NTKAnalysis App: Example of R Code

NOTE: Deleting an R Code will NOT automatically refresh all the modules below. See [Delete text/document sections](#) for reference. Click the *Refresh Analysis/Run all* button to apply the removal of R Code to the NTK Document.

3.8 Document Configuration

Document configuration allows to view /set global configurations, as well as add custom variables (binary contrasts). All the filtering applied in Document Configuration impacts the entire NTK Document.

Document configuration allows to:

- Avoid (most) repetitive interactions with each analysis module
- Define the analysis population (global filter):
- Prepare the data for analysis:
 - enhance with new variables,
 - reduce variables,
 - create new variables.

In the Configurations section, define binary contrasts and/or filter data globally

1. Click the *Configuration* button on the far-right side of the screen
2. A window opens with the configuration options
3. Set binary contrasts
4. Filter the data
5. Click the *Apply* button
6. The configuration is applied to the entire NTK Document.

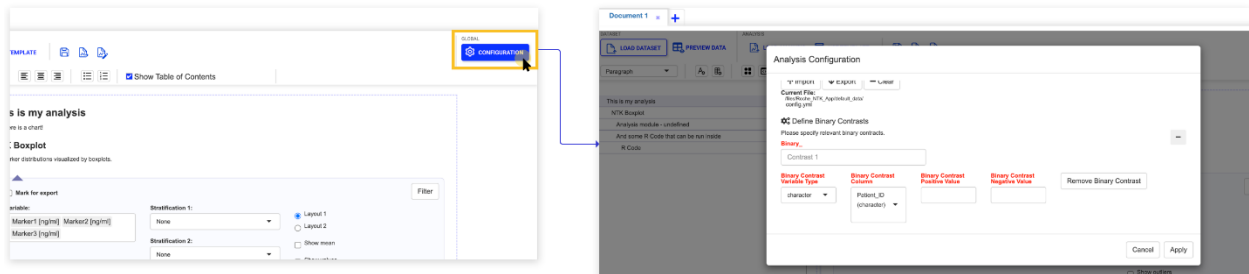


Fig. 3-14 NTKAnalysis App: Global Configuration

3.8.1 Define Binary Contrasts

Binary contrasts set the parameters for the population. Binary contrasts allow to create, enhance, or reduce variables in the dataset.

1. Input the Binary Contrast name in the configuration window
2. Select the Type of Binary Contrast (numeric/character)
3. Select the column in the dataset to apply the Binary Contrast
4. Select the Binary Contrast variable type:
 - a. input field if variable type is character
 - b. drop down for > or < cut-off if variable type is numeric
5. Input the Binary Contrast cut-off
6. Set the Positive and Negative value labels
7. Repeat the actions above for adding additional binary contrasts from the *Add Binary Contrast* button displayed after the last set Binary Contrast
8. Click the *Apply* button
9. Binary Contrasts are applied to the entire NTK Document and create an extended dataset

3.8.2 Filter Data

This option applies data filtering globally, throughout the NTK Document.

1. Click the *Filter Data* button in the configuration window
2. Select the variable to be filtered
3. Select the operator
4. Select values
5. Click the *Apply* button
6. Repeat this action for every filter
7. Your data filtering is applied throughout the entire NTK Document and all the analysis modules will only analyze the data which were set in this step

3.9 Create New Document

1. Click the “+” button on the right side of a document tab

2. A new document is opened in the NTK Analysis App
3. Repeat this action to open multiple documents in the NTKAnalysis App

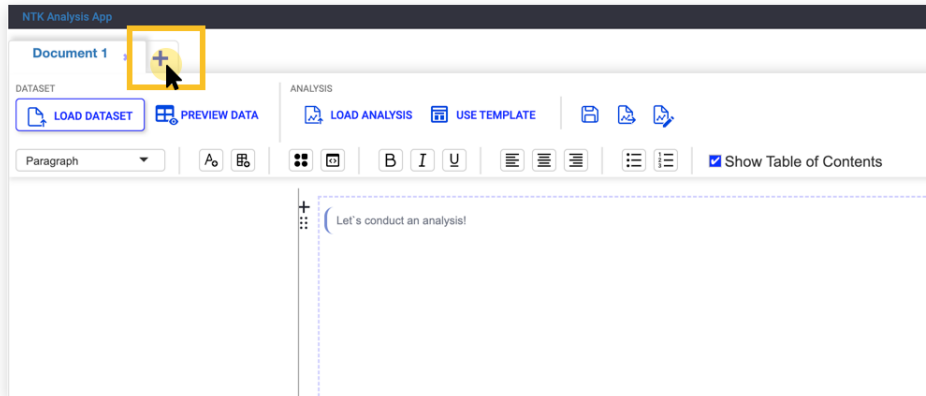


Fig. 3-15 NTKAnalysis App: Create a new document

3.10 Side by Side Visualization

Documents can be compared in the NTKAnalysis App.

1. Click the *Pin* on the left side of the document tab displayed on hover, to enter compare mode.
2. The pinned document will be used as reference (locked) on the left side of the screen.
3. Other documents will be displayed on the right side. Click through the document tabs to compare them with the referenced document
4. Scroll through the documents displayed in compare mode


NOTE: The documents are editable in-text, but the toolbar is not available in compare mode. To view the documents' toolbars, unpin the referenced document.



Fig. 3-16 NTKAnalysis App: Side by Side visualization

3.11 Save Document

Save your NTK Document in the workspace after you have concluded your data analysis.

1. Click the  (Save) button
2. Select the file location for the NTK Document
 - a. Create a new folder (optional)
3. Name the NTK Document

4. Click the *Save* button
5. Your NTK Document is saved in the workspace and can be loaded again at any time in the NTK Analysis App

You can choose to save the document in different formats by changing the type of it (near the name).

The available formats are:

- NTK Document - this is a document storing inside the entire analysis (together with it the dataset and the dictionary file gets saved).
- NTK Template - this is a special type of document that can store only the structure of the analysis so it can be later used with any type of dataset.
- PDF - the document will be exported as a pdf
- HTML Pdf - similar with PDF but using a different more faster engine
- RMD - a rmd file containing all the cunks required to generate markdowns. This file can be altered inside R Studio
- HTML - the document will be exported as and HTML file

NOTE:

The mapping file and dataset file are saved automatically when saving the NTK document, in the selected folder. It is saved with the extension .map and can be reloaded in the NTKCuration App to curate a dataset. (See [Load mapping](#) section for reference).

3.12 Export Results

Select which results to export. Exported results do not contain raw data and can be safely shared with partners.

1. Tick the *Mark for export* box displayed on the top of each analysis module in the NTK Document
2. Click the *Export Results* icon
3. Input the source name (e.g., cohort 1)
4. Select the file location

Exporting the results is a crucial step to performing meta-analysis, namely sharing the results between workspaces and comparing statistical analyses.

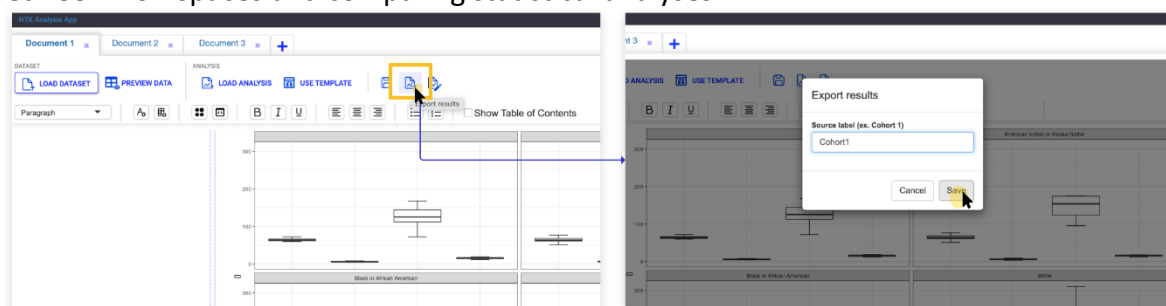


Fig. 3-17 NTKAnalysis App: Export Results

4 NTKMeta-Analysis App

The NTKMeta-Analysis App allows you to compare your biomarker data with other data across the community. The cloud can be harnessed to select, stratify, and compare biomarkers and clinical characteristics in a global way. The NTK meta-analysis app also sheds light on shared data, resources, and objectives, providing support for existing and new clinical use cases based on collective evidence. This in turn enables the contextualization of results and the generation of new hypotheses and evidence.

This section provides the use cases for the NTKMeta-Analysis App. **Click through the list below to jump to a subsection.**

[Manage results](#)

[Meta-Analysis Modules](#)

[Load Meta-Analysis](#)

[Meta-Analysis Side by Side Visualization](#)

[Save Meta-Analysis Document](#)

4.1 Manage results

Analysis results from different sources, analyzed in the same way (e.g., boxplots) can be compared in this section.

1. Click the *Manage Results* button
2. Click the *Add Results* button
3. Select the analysis results to be loaded in the NTKMeta-Analysis App
4. Repeat this step for all the results you want to load in the NTKMeta-Analysis App
5. Analysis results are loaded and differentiated by modules (e.g., if an analysis results file has boxplots, correlograms and summary tables, each module will be displayed separately in the window. Thus, you can select which module to include in the Meta-Analysis from each results file).
6. Click each module to display its graphical representation
7. Tick the boxes of the results you wish to add in the NTKMeta-Analysis App
8. Click *Use Selected* button
9. Analysis results are loaded in the NTKMeta-Analysis App



Fig. 4-1 NTKMeta-Analysis App: Manage results

4.2 Meta-Analysis Modules

Meta-Analysis modules allow to compare results from different sources, protecting raw data. Meta-Analysis modules can be loaded either from the toolbar or directly in-text. See [Insert an analysis module](#) section for reference.

Only the modules which were added as results will be displayed in this step. E.g., if the results added in the NTKMeta-Analysis App contain only boxplots, the only module available to be selected will be the boxplot.

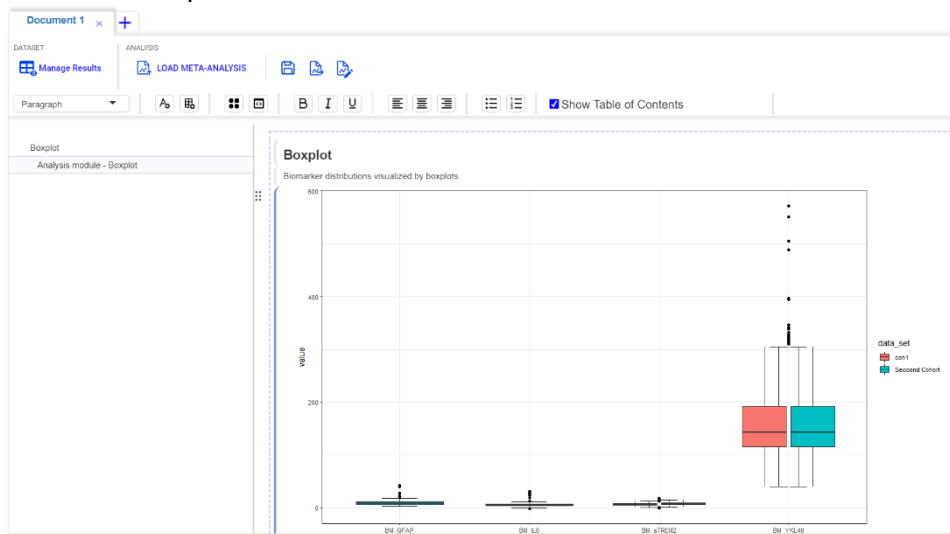


Fig. 4-2 NTKMeta-Analysis App: Meta-Analysis modules - Boxplot

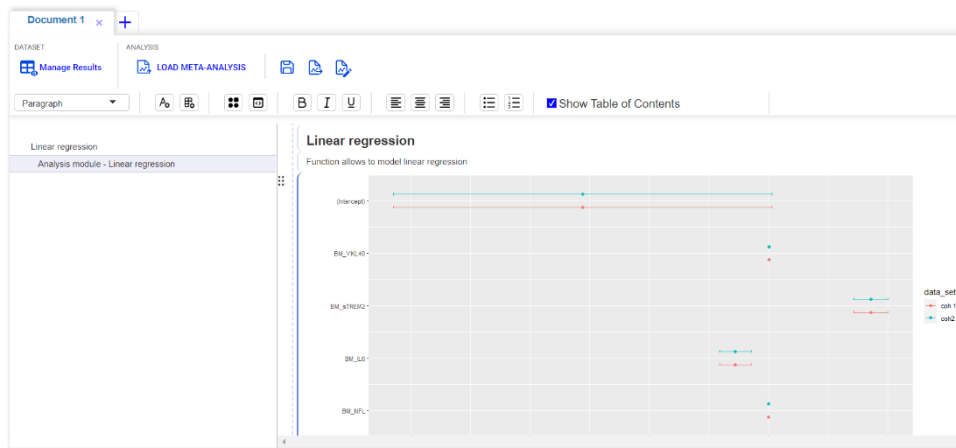


Fig. 4-3 NTKMeta-Analysis App: Meta-Analysis modules – Linear regression


4.3 Meta-Analysis Side by Side Visualization and text editing

Just like in the NTKAnalysis App, the NTKMeta-Analysis app has the same capabilities for text editing and side by side visualization.

See [Text Editing](#) and [Side by Side Visualization](#) sections for reference.

4.4 Save Meta-Analysis Document

Save the NTK Document in the workspace after you have concluded your data analysis.

6. Click the  (Save) button
7. Select the file location for the NTK Document
 - a. Create a new folder (optional)
8. Name the NTK Document
9. Click the Save button
10. Your NTK Document is saved in the workspace and can be loaded again at any time in the NTKApp

4.5 Share Meta-Analysis

Use Aridhia Airlock to copy files to another workspace.

5 FAQs

5.1 NTKCuration App

Do I have to load a dataset file in the NTKCuration App prior to perform the mapping?

Yes. A dataset file must be loaded to map the variables.

Can I load more than one dataset file to perform mapping?

No, mapping of the variables must be done on just one dataset file.

What is the accepted format of my dataset file?

Your dataset file MUST be in .csv format.

Do I have to save my mapping file every time I map a new variable?

Yes, your mapping file must be saved every time you map a new variable or remove a variable. You can overwrite your mapping file or create a new version.

Do I have to save my mapping every time I click through categories?

No, your variables remain in the mapped fields regardless of whether you click through categories. However, remember to save your mapping file when you finish mapping your variables.

Can I map a dataset column to more than one variable field?

No, one dataset column must be mapped to just one variable field. If you wish to map a dataset column to another variable, you must first remove it from the field where you have previously mapped it.

What is a data dictionary and how can I extend it?

A data dictionary is a compendium of variables, their types, allowed values, units, and levels. The NTK Data dictionary is automatically loaded when launching the NTKCuration App. It encompasses the categories and their inherent variables, as well as the type of data allowed for a specific variable and the variable units. Some variables have multiple allowed values (e.g., gender), which are also defined in the NTK Data Dictionary.

When you save your curated dataset with a newly created variable, the NTK Data Dictionary is automatically extended with your custom variables and saved in the specified location (along with the mapping file). This helps you when sharing your results with your partners, for them to understand how your data is structured and how to perform their analyses in accordance with your variable dictionary.

5.2 NTKAnalysis App

What is an NTK Document?

An NTK Document is the output of the NTKAnalysis App. It is an interactive document, where you can analyze and configure your data, view results, and save them in a safe and reliable way.

Is it mandatory to load my own dataset file to perform data analysis?

No, the NTKAnalysis App automatically loads a demo dataset file, if you wish to explore the analysis modules. However, we advise you to perform analyses on your dataset.

Is it mandatory to provide a curated dataset to perform data analysis?

No, you can perform your analysis on a dataset which was not previously curated, but we strongly advise to curate your dataset before performing any analyses. Curating your dataset beforehand harmonizes it, creates your custom dictionary, and makes it easier for you to share your results with partners in the Meta-Analysis App. See [NTKCuration App](#) section for a step-by-step guide to curating your dataset.

What are analysis modules?

Analysis modules are built-in models in the NTKAnalysis App to analyze and display data. They allow you to run inferential and descriptive statistics in an intuitive and easy way, depending on your clinical questions and methodology.

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