



User's Guide for Windows with Stata, SAS, R, and Python

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Let's Stay in Touch!

The StatTag team appreciates all feedback and would love to hear from you!

In particular:

1. Did you find StatTag easy to use? Was it intuitive?
2. Did StatTag function as expected? Were you able to incorporate your working statistical package code? Were you able to tag documents?
3. Did you encounter any errors? If so, what happened? Can you tell us how to reproduce them?

Please email your feedback to: StatTag@northwestern.edu



Open and Free

StatTag is open source and provided for free, courtesy of Northwestern University under a grant by the National Institutes of Health.

Visit us on GitHub: <http://github.com/stattag>

1.0 Introduction

StatTag is user-friendly software that integrates statistical code with document preparation in Microsoft Word. StatTag facilitates reproducible research by connecting Word documents, such as a manuscript, to associated statistical code. Word documents prepared with StatTag are reproducible dynamic documents: statistical results in the document can be automatically updated if either statistical code or data change. In addition, StatTag allows statistical code to be edited directly from Microsoft Word.

StatTag is provided as a free Word plug-in written in C#. Once installed, StatTag is accessible from the Word toolbar. This user's guide covers use of StatTag within a Windows environment for Microsoft Word partnered with:

- Stata (StataCorp. College Station, TX: StataCorp LP)
- SAS (SAS Institute Inc: Release 9.4. Cary, NC)
- R (R Foundation for Statistical Computing. Vienna, Austria)
- R Markdown (R Studio Inc. Vienna, Austria)
- Python (Python Software Foundation. Wilmington, DE)

Requirements

StatTag requires the following

- Windows 7 and above
- Microsoft Word 2016 and above
- One or more supported statistical applications
 - Stata 13 and above
 - SAS 9.4
 - R 4.3 and above (*see [Appendix C](#) for more information about older versions of R*)
 - R Markdown (R Studio, R)
 - Python 3.5 and above


2.0 Setup

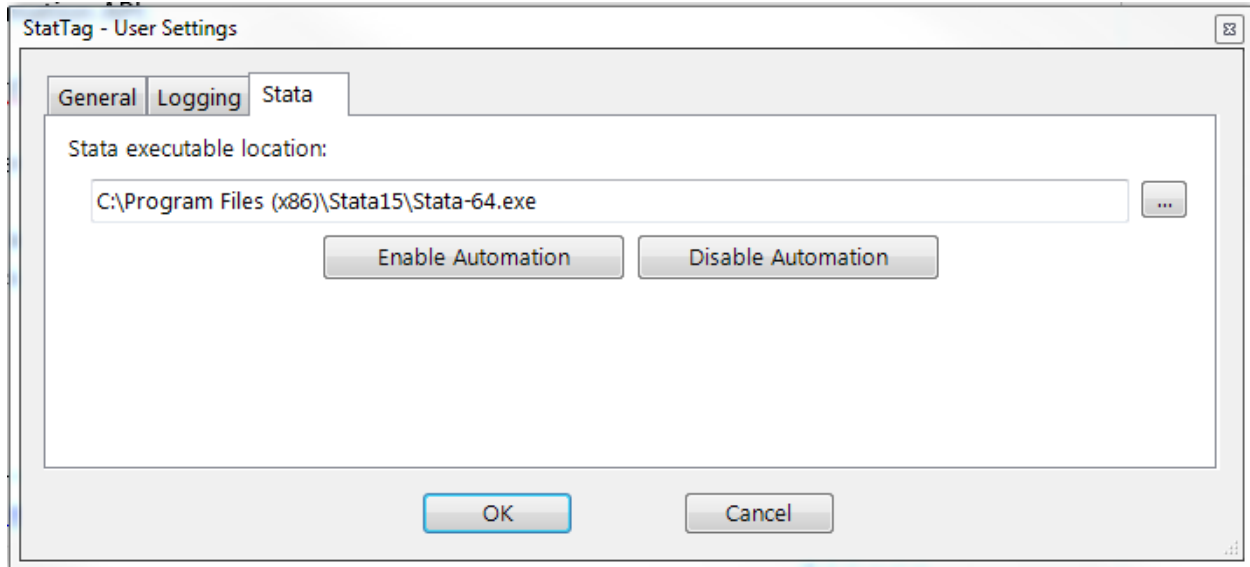
1. **Download** the StatTag software file at <http://www.stattag.org>
2. **Install** the software by clicking “Run” when prompted, and follow the InstallShield Wizard.
3. **Open** Microsoft Word. If StatTag has installed successfully, your Word toolbar will include a “StatTag” tab that will look like this:



Steps 4-8 are for Stata users ONLY



4. **Select** the “StatTag” tab on the top tool bar.
5. **Select** the “User Settings” icon 
6. **Enable** the Stata API through the Stata tab. Enter the file path for Stata on your computer. This may be something like C:\Program Files (x86)\Stata15\StataSE-64.exe.



Tip: To locate the file path of your Stata program, open Stata, and type ‘sysdir’ in the command line. This returns the installation pathway. Open the folder in Windows Explorer to verify the pathway and identify the name of your Stata executable (.exe) file.

7. **Click** ‘Enable Automation’ after the file path has been set to allow StatTag and Stata to communicate via the Stata Automation API. **You must click ‘Enable Automation’ in order for StatTag to work.**
8. **Click** ‘OK’ to return to the main screen.



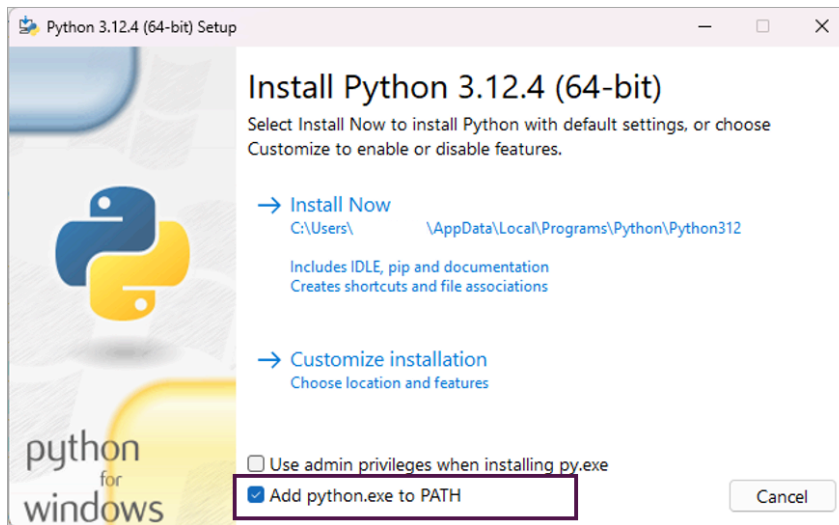
Note: You must install the StatTag plug-in first, before enabling the Stata Automation API. Both installation of the StatTag plug-in and enabling the Stata Automation API require administrator access on your computer. The Stata Automation Application Program Interface (API) allows StatTag and Stata to exchange information. StatTag sends ‘calls’ to Stata to execute statistical code, and Stata in turn sends back the results of the code to be inserted in the Word document. You only have to do this step on initial installation of StatTag. Updates to StatTag will not require re-enabling Stata Automation.

Steps 9-11 are for Python users ONLY

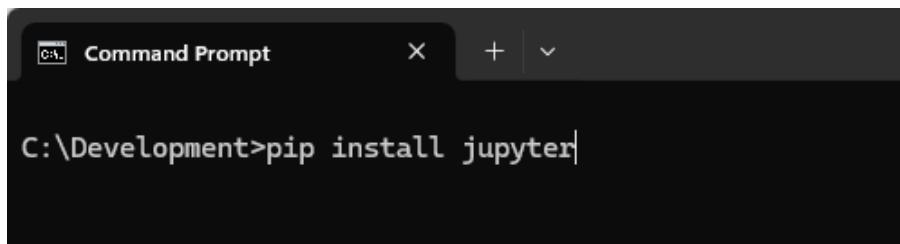


Python works with StatTag through Jupyter. Both Python (version 3.5 or above) and Jupyter must be installed locally. If Jupyter and Python are already installed, the following instructions can be skipped. The following instructions are based on installation instructions from Jupyter, but may vary across machine. Full instructions are available at <https://jupyter.org/install>.

9. **Download** Python from: <https://www.python.org/downloads/>
10. **Install** Python by selecting the release compatible with your operating system. You can use the default install options, or customize the installation and setup location, if you prefer. Regardless, you should check the option to add python.exe to your PATH.



11. **Set up Jupyter** by running the following from a command prompt: `pip install jupyter`




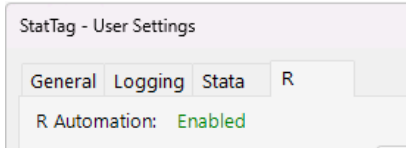
Steps 12-19 are for R / R Markdown users ONLY



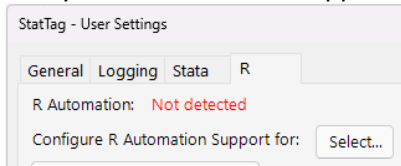
Starting with version 7.0, StatTag uses Jupyter to support its integration with R. This requires having the [IRkernel](#) package set up for your R installation. If you do not have IRkernel already installed, you may do so separately or use the built-in setup that StatTag provides.

12. Ensure you are running R 4.3 or higher. If you need previous R version, please see [Appendix C](#).

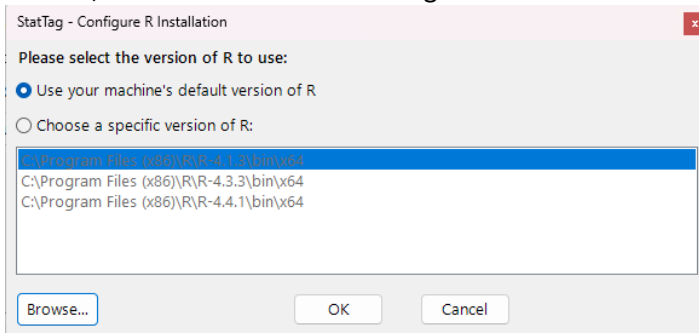
13. **Select** the “StatTag” tab on the top tool bar.
14. **Select** the “User Settings” icon 
15. **Select** the “R” tab.
16. If “R Automation” is showing as “Enabled”, no further action is needed on your part. Otherwise, proceed to the next step



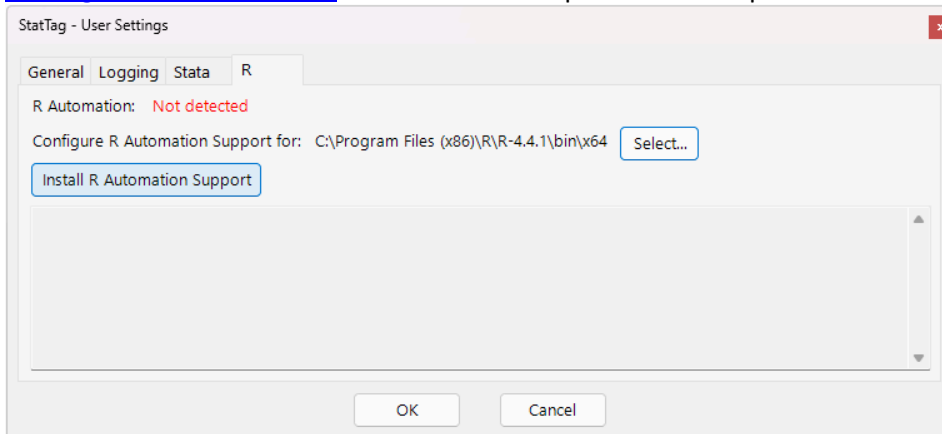
17. **Install** the necessary support for R. First, click the “Select...” button to choose the version of R that you want to enable support for.



18. **Choose** the version of R from the list – either allowing StatTag to automatically detect the current version of R, or by selecting a version of R from the list. If you don't see your version of R listed, select “Browse...” and navigate to where R.exe is installed.



19. Click “Install R Automation Support” to begin the setup. This will attempt to download, install, and configure IRkernel for your current, active R version. You will see details about the setup, and if it succeeds or fails. If have problems completing this step, please reach out to StatTag@northwestern.edu for assistance and provide the output from the setup.



3.0 Basics of StatTag

StatTag will link any code file written for supported statistical applications (Stata (.do), SAS (.sas), R (.R), R Markdown (.Rmd), or Python (.py)) with your Word document, run the code file from Word, and insert any tagged results.

There are three main steps to using StatTag:

1. **Link code file(s).** Connect a Word document to files containing statistical code (i.e. .do, .sas, .R, .Rmd, or .py file).
2. **Create tags.** Annotate the code files to tag results, tables, or figures that are of interest.
3. **Insert tags.** Instruct StatTag where to insert those results within the Word document itself.



Note: We recommend that you begin with a code file that already contains your working statistical code and generates the results of interest. With StatTag, it is possible to write your statistical code directly from Word, but not as convenient as writing your code files in the statistical program's editor.



Note: This guide uses example code files to explain the use of StatTag. The example code files are available from <https://github.com/StatTag/Simple-Code-Examples>, along with raw data and a Word document ready for tags to be embedded. To follow along with the User Guide, open the Word document.

3.1 StatTag Elements

Microsoft Word Document

A Word document represents the “hub” for your team’s document authoring. Word provides the document formatting and editing tools.

Code File

A Code File is text file with commands that are intended to run in any of the supported statistical applications (currently Stata, SAS, R, R Markdown, Python, and possibly Matlab or other programs in future releases). A code file is the source file that your project or study uses to compute findings from data sets. With StatTag, code files are “linked” to Microsoft Word documents so that they can be imported and used. The code files are read so that you can identify sections that produce output that you wish to embed in Word.

Tag

A Tag is a unit of statistical output from your Code File that you would like to treat as a unique, reproducible data element. Tags in your code file(s) identify numbers, tables, figures, or verbatim output (raw output from the statistical program console) that you would like to embed in your Word document.

A tag is defined by three components, which make up the “identity” for a tag:

- **Code File:** The source statistical code file where the tag is defined

- **Tag name:** The unique, user-friendly name for a tag
- **Tag format:** The combination of attributes that define how a tag's output should be formatted within a Microsoft Word document

3.2 Navigating StatTag for Windows




StatTag for Windows performs the same functions as StatTag for macOS.

The StatTag Word Toolbar




The StatTag toolbar has two groups of buttons which provide quick access to key functions



Manage Functions

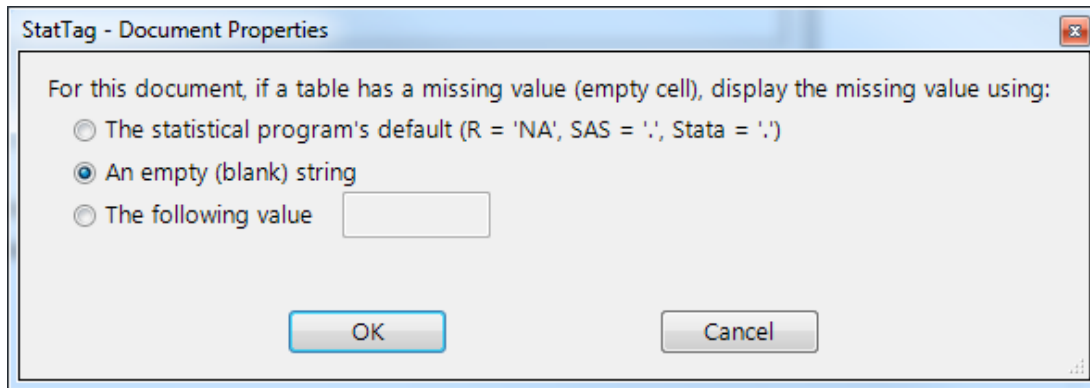
	Code Files	Opens the Code Files Manager. See “Code Files Manager” below in Section 3.3 .
	Tags	Opens the Tag Manager. See “Tag Manager” below in Section 3.3 .
	Document Properties	Controls default formatting behavior applied to the active document, See “Document Properties” below.

Support Functions

	User Settings	Opens the Settings window. See “Settings” below.
	About	Opens the About window. Provides basic information about StatTag as well as links to the StatTag team's email address and GitHub repository .
	Help	Opens StatTag's help documentation

Document Properties

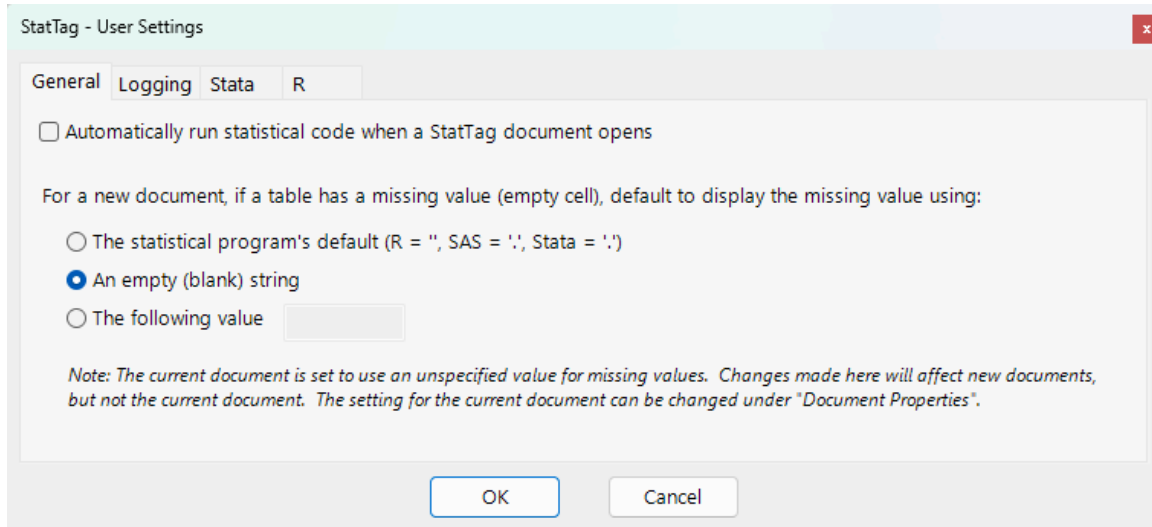
The Document Properties window controls default formatting behavior applied to the active document. This includes how missing values or empty table cells should be depicted within word.



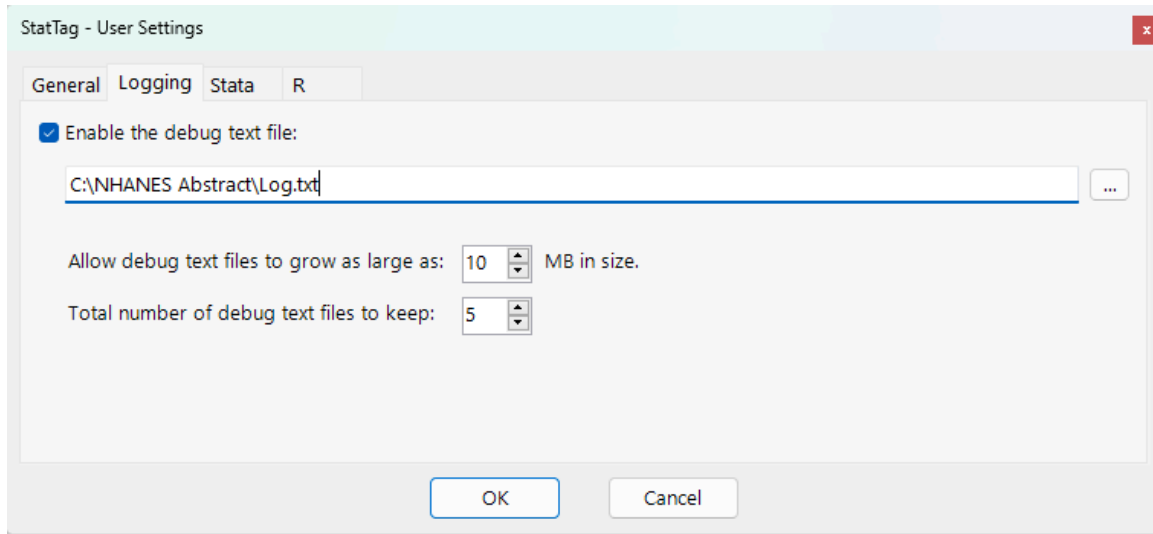
User Settings

The Settings window controls aspects of StatTag's operation.

The General tab 1) controls execution of the statistical code when a Word document associated with a code file through StatTag is opened, 2) the default method for how missing values or empty table cells should be depicted for all Word documents.



The Logging tab controls generation of a log file that can be used for troubleshooting. This is disabled by default, but if you encounter errors and would like to request assistance please do the following: (1) enable the debug file, by checking the box, which will write a plain text file to your computer; (2) run your program to generate the errors, and; (3) send the debug file to StatTag@northwestern.edu.



The Stata tab allows connection of the Stata API. This tab was used during StatTag setup to allow StatTag to interface with Stata. These settings can be changed or updated at any time. If you are using Stata, and have not configured this, see page 4 for more information about configuring Stata.

About

The About icon will open a window containing the version number of StatTag that you are using, and information regarding citation, usage, and licenses related to StatTag.

Help

The Help icon will open the User Guide from within Word. If you need additional help or support, email StatTag@northwestern.edu or visit the StatTag website at <http://sites.northwestern.edu/stattag/> to interact with the user community.

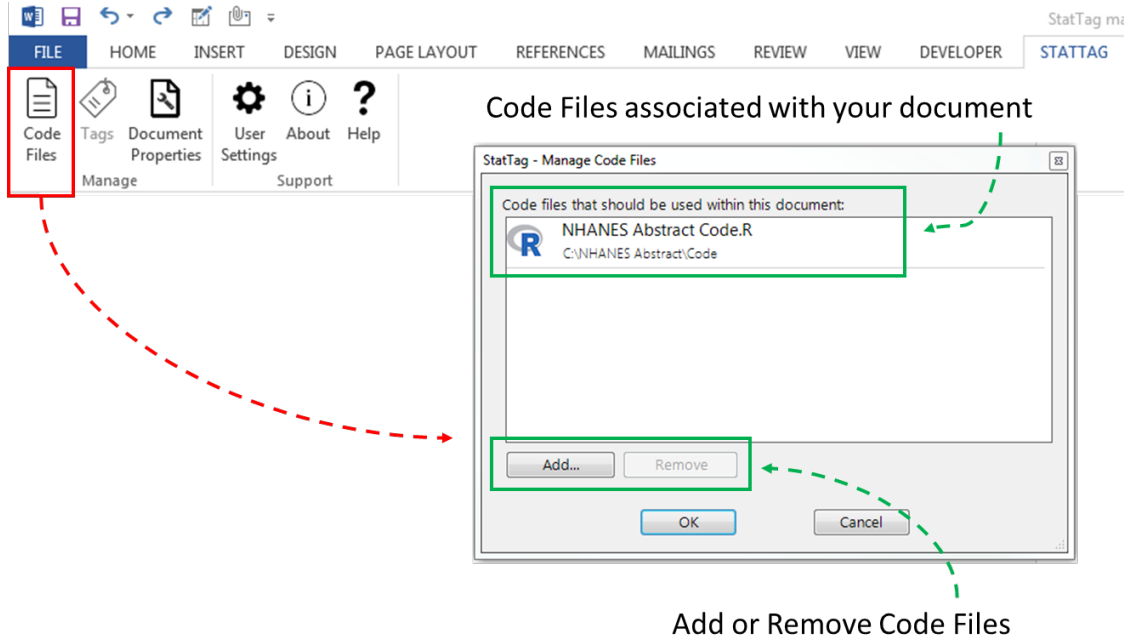
3.3 Interacting with the StatTag for Windows interface

Code Files Manager

The *Code Files* function enables linking one or more code files with your Word document. The first step to using StatTag is to connect your Word document with your statistical code. Note that it is possible to connect multiple code files to one Word document, and you may use code files from Stata, SAS, R, R Markdown and/or Python in a single document. This function will show any code files currently linked to you active Word document.

You can:

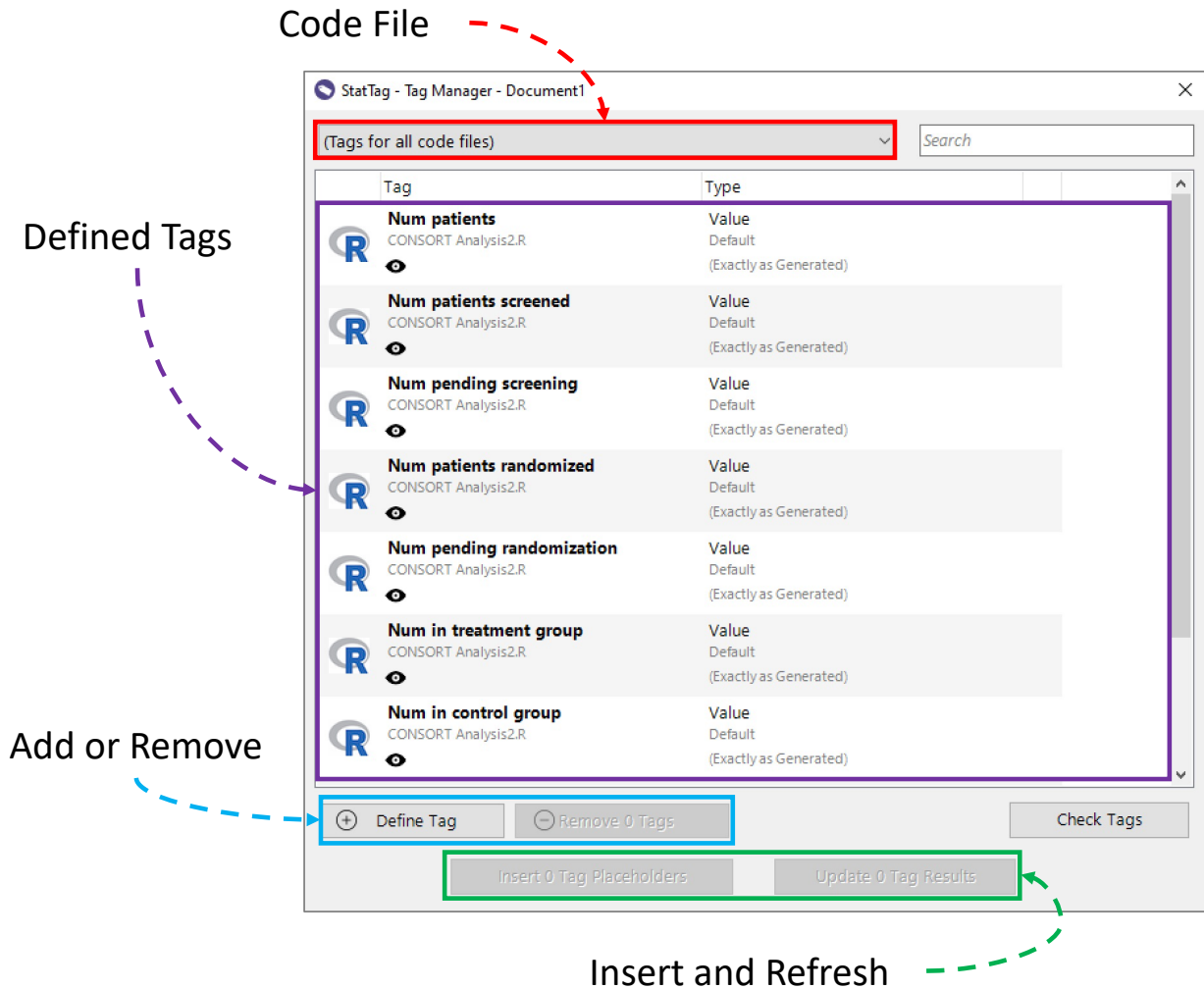
- View a list of code files currently associated with your document
- Attach or remove code files using the Add and Remove buttons



Note: You can connect multiple code files to a single Word document.

Tag Manager

Adding a code file will cause the *Tags* function to become available, which opens the Tag Manager. The Tag Manager displays tags associated with the selected code file(s). From the Tags Manager, tags can be managed (define, add, remove), inserted, and refreshed.

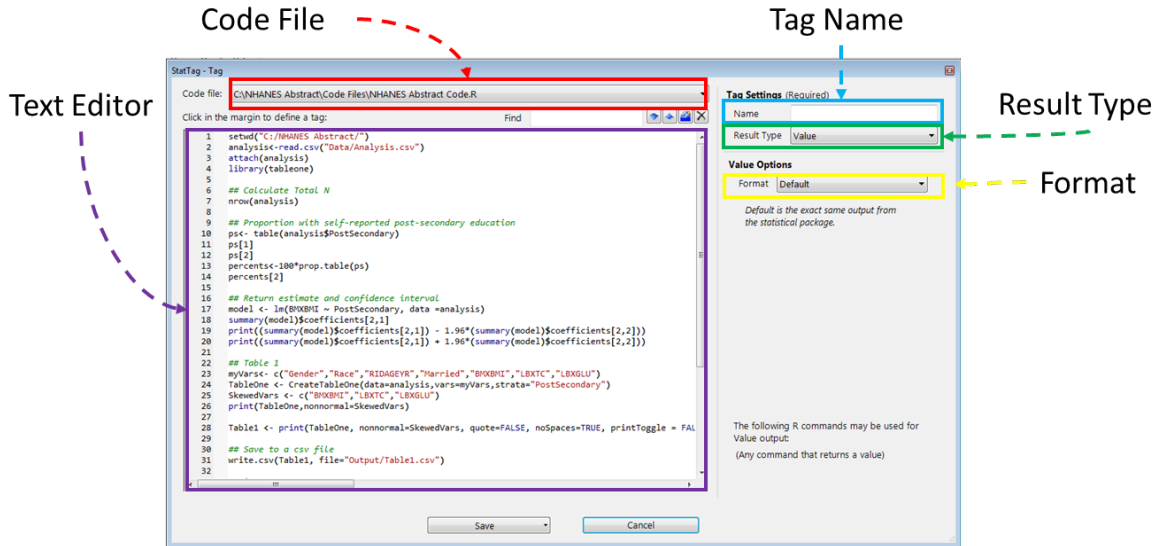


The Tag Manager has the following components:

- A. Code File
 - i. By default the tags for all associated code files are displayed.
 - ii. If you have 2 or more code files linked to your document, use the drop down menu to select the code file you are using to filter the displayed tags.
- B. Defined Tags
 - i. All tags defined in the code file(s) are displayed.
- C. Add or Remove
 - i. These functions are used to define new tags (Define) or remove tag(s) (Remove) from the code file(s)
- D. Insert and Update
 - i. These functions are used to insert or update selected tags.

Tag Editor

The tag editor drives interaction with StatTag. It is where tags are defined within a referenced code file and information is added to enable StatTag to link output to your Microsoft Word document. Selecting the *Define Tag* button or double clicking on an existing tag will open the Tag Editor.



The Tag Editor has the following components:


- A. Code File
 - i. If you have only 1 code file linked to your Word document, this will be automatically selected in the drop down menu
 - ii. If you have 2 or more code files linked to your document, use the drop down menu to select the code file you are using to make the new tags.
- B. Text editor
 - i. The statistical code may be edited directly through StatTag. Any changes you make are made to the file itself and are saved once you press the "Save" button.
- C. Tag Name
 - ii. The tag name is the unique name of the result of interest, and should only be used once within each code file to identify a result. StatTag will warn you if you try to use a tag name more than once.
 - iii. The tag name can contain any string of characters including special characters (with the exception of the pipe, |) and spaces.
- D. Result Type
 - i. This section informs StatTag if the tag will be a value, figure, table, or verbatim output.
 - ii. More information on tags for tables, figures and verbatim output is provided in [Section 4](#).
- E. Format
 - i. Formatting options are specific to the type of result inserted.
 - ii. More information on formatting is provided in [Section 5](#).

3.4 Managing Tags

The Tag Manager will become active when one or more code file(s) is linked to the active Word document. Selecting one or more code files will filter the list of displayed tags.


Tags in your code file(s) identify numbers, tables, figures, or verbatim output (i.e. raw output from the statistical program console) that you would like to embed in your Word document. Tags can be inserted through StatTag, using the following instructions, or for the more advanced user, can be directly written into your code files using a text editor of the user's choice. Tags are specifically formatted text that Stata, SAS, or R interpret as comments, but that allows StatTag to pull results into Word.

Adding Tags

1. **Open the Tag Manager** by clicking on “Tags” 
2. Click on the **Define Tag (+)** button.
3. The **Tag Editor** window opens showing the statistical code.
4. After a tag has been defined, click **Save** or **Save and define another**.

Information on adding tags is described in greater detail in [Section 4.3](#).


Removing Tags

1. **Open the Tag Manager** by clicking on “Tags” 
2. Select the tag(s) you wish to remove from the code file by clicking on them once
3. Click on the **Remove Tag (-)** button.



Tip: To select multiple tags hold the ([shift](#)) key while clicking and selecting a range of tags

Modifying Tags

1. **Open the Tag Manager** by clicking on “Tags” 
2. Select the tag you wish to modify by **double-clicking** on the tag to open the Tag Editor
3. Modify the tag settings and select **save**

Inserting Tag Placeholders

1. **Select one or more tags** in the tag list.
2. Click on the “**Insert X Tag Placeholders**” button.
3. This action inserts a placeholder for the tag, which consists of the tag name in brackets (e.g. “[my tag name]”) in your Word document. This allows you to insert many tags without ever running the statistical code file.
4. You will see a progress bar while the tags process and, finally, feedback if there were issues.

Updating Tags

1. **Select one or more tags** in the tag list.
2. Click on the “**Update X Tag Results**” button.

3. This action will run the code file and fills in placeholders (or updates existing tags) within the Word document.
4. You will see a progress bar while the tags process and, finally, feedback if there were issues.

4.0 Defining Tags






4.1 Structure

A Tag is a unit of statistical output from your Code File that you would like to treat as a unique, reproducible data element. Tags in your code file(s) identify numbers, tables, figures, or verbatim output (raw output from the statistical program console) that you would like to embed in your Word document.

A tag is defined by three components, which make up the “identity” for a tag:

- **Code File:** The source statistical code file where the tag is defined
- **Tag name:** The unique, user-friendly name for a tag
- **Tag format:** The combination of attributes that define how a tag’s output should be formatted within a Microsoft Word document

Tag names should be unique within code files and, ideally, unique across the document (although the latter is not required, it’s suggested to avoid potential confusion and so that it’s easier for users to quickly identify tags). Four types of results can be tagged.

Type			 or 	
Numeric Values	display	%put	Any command that returns a value	Any command that returns a value
Tables	matrix list, any command that returns a .xls, .xlsx, or .csv file	ODS CSV	Any command that returns a data frame, matrix, vector or list, any command that returns a .xls, .xlsx, or .csv file	Any command that returns an array, list, set, or Pandas data frame; any command that returns a .xls, .xlsx, or .csv file
Figures	graph export	ODS PDF	pdf, win.metafile, png, jpeg, bmp, postscript	Any command that saves a figure to an image file
Verbatim	Any Code	Any Code	Any Code	Any Code



Tip: When using an R Markdown file, the code must be contained within “code chunks”. Inline code is not supported by StatTag. If an R Markdown code file has the same file name and pathway as an R code file, you should rename one or the other.

In order to return results from your statistical analysis to Word, your results must be created and either printed to the results window of your statistical program or to file through one of the above commands and encapsulated in a tag. Other lines in your statistical code should not be encapsulated by tags, as they may cause errors.

Values

Values are returned to StatTag and then inserted into Word with the `display` (Stata) or `%put` (SAS) commands, or R/Python commands that return a value. The `display` and `%put` commands are used in Stata and SAS code respectively to print strings or scalar values to the results window. They will not return data in any other format, such as a matrix or table.



The `display` command is typically used in Stata code with the `return` command to retrieve stored results, or with local or global macro variables.



The `%put` command is typically used in SAS code to store values or strings as local macro variables.



R commands that return a single value (e.g., `print`) may be used. If the value returned has more than one element (such as a vector), only the first element will be used.



Python commands that return a single value (e.g., `print`) may be used. If the value returned has more than one element (such as a list), only the first element will be used.

Tables

Tables are returned to Word with the `matrix list` (Stata) or `ODS CSV` (SAS) commands, or R commands that return a collection of values.



The `matrix list` command is used in Stata code to print a matrix to the results window. The `matrix list` command is typically used after creation of a matrix with the `mkmat`, `matrix define`, `estout`, or `estimates table` commands.



The `ODS CSV` command is used in SAS code to redirect output to a location on file, instead of the results window. The file location is used by StatTag to pull in the results of interest.



R commands that return a collection of values (data frame, matrix, vector, or list) can be used as table results by StatTag, as well as any command that saves a .xls or .csv file.



Python commands that return a collection of values (array, list, set, or Pandas data frame) can be used as table results by StatTag, as well as any command that saves a .xls or .csv file.

Figures

Figures are returned to Word with the [graph export](#) (Stata), [ODS PDF](#) (SAS), pdf, win.metafile, png, jpeg, bmp, or postscript (R) commands.



The [graph export](#) command is used in Stata code to save a graph or figure to file outside of Stata, the location of which is specified by the user. StatTag will retrieve the file to insert into Word. The [graph export](#) command expects a pathway and file name to be specified along with the file format, and the replace option to overwrite an existing file as required. The command will export the last graph rendered in Stata.



The [ODS PDF](#) command is used in SAS code to save results of other commands to a pdf file outside of SAS, the location of which is specified by the user. StatTag will retrieve the file to insert into Word. The [ODS PDF](#) command expects a pathway and file name to be specified. The command will export any contained output that would be otherwise printed in the results window.



The pdf, win.metafile, png, jpeg, bmp and postscript commands are used by R to save a graph or figure to a file outside of R, the location of which is specified by the user. StatTag will retrieve the file to insert into Word.



Any command within Python that saves a graph for figure to a file can be used by StatTag. StatTag will retrieve the file to insert into Word.

Verbatim

Verbatim results echo any printed output within the statistical program. Inserted output will be formatted text in a text box. The inserted text may be further formatted in Word.



Tagging code as verbatim in Stata will result in the insertion of any output printed to the Stata results screen.



Tagging code as verbatim in SAS will result in the insertion of any information printed to the SAS log screen.



Tagging code as verbatim in R will result in the insertion of any output printed to the R console.



Tagging code as verbatim in Python will result in the insertion of any output printed to the Python console.

4.2 Syntax

A tag always starts with `**>>>ST:Value(Label=" ")` and may contain additional information based on the type of tag (number, table, or figure) it identifies. The tag always ends with `**<<<`. Examples of tags for a numeric value, a table, a figure and verbatim output are listed below.

```
**>>>ST:Value(Label=" ", Type="")
code
**<<<
```

```
**>>>ST:Table(Label="", Type="", AllowInvalid=True, Decimals=0, Thousands=False)
code
**<<<
```

```
**>>>ST:Figure(Label="",)
code
**<<<
```

```
**>>>ST:Verbatim(Label="")
code
**<<<
```

If tags are made through StatTag, the text (`***>>> **<<<`) will be written into your statistical code by the plug-in. The Label, Type and Table parameters are defined in the Tag editor window ([Section 3.1](#)). The more advanced user may also directly write tags into statistical code. If written directly in the statistical code tags must include both the opening (`***>>>`) and closing (`**<<<`) comments, and have a name ("Label").



Note: Tags cannot be nested within each other. A tag should encapsulate exactly one keyword command (i.e. `display`, `matrix list`, `%put`, etc.)

4.3 Process

Tags are defined and inserted through the Tag Manager.

Define

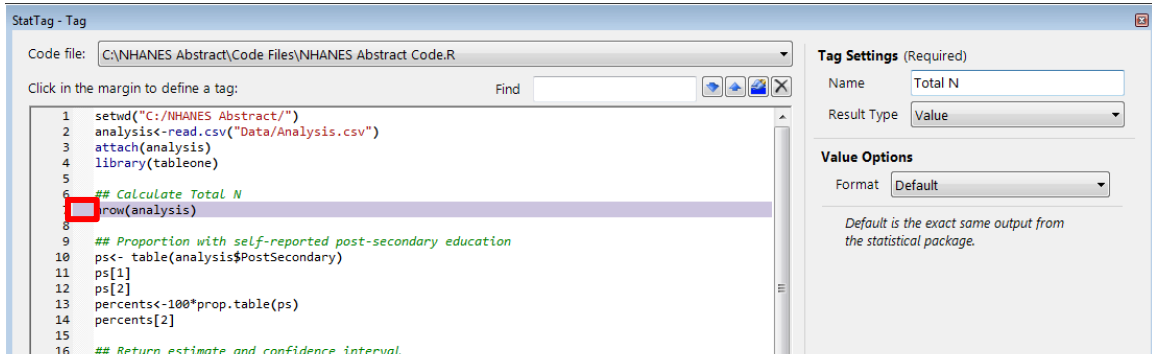
To define a tag:

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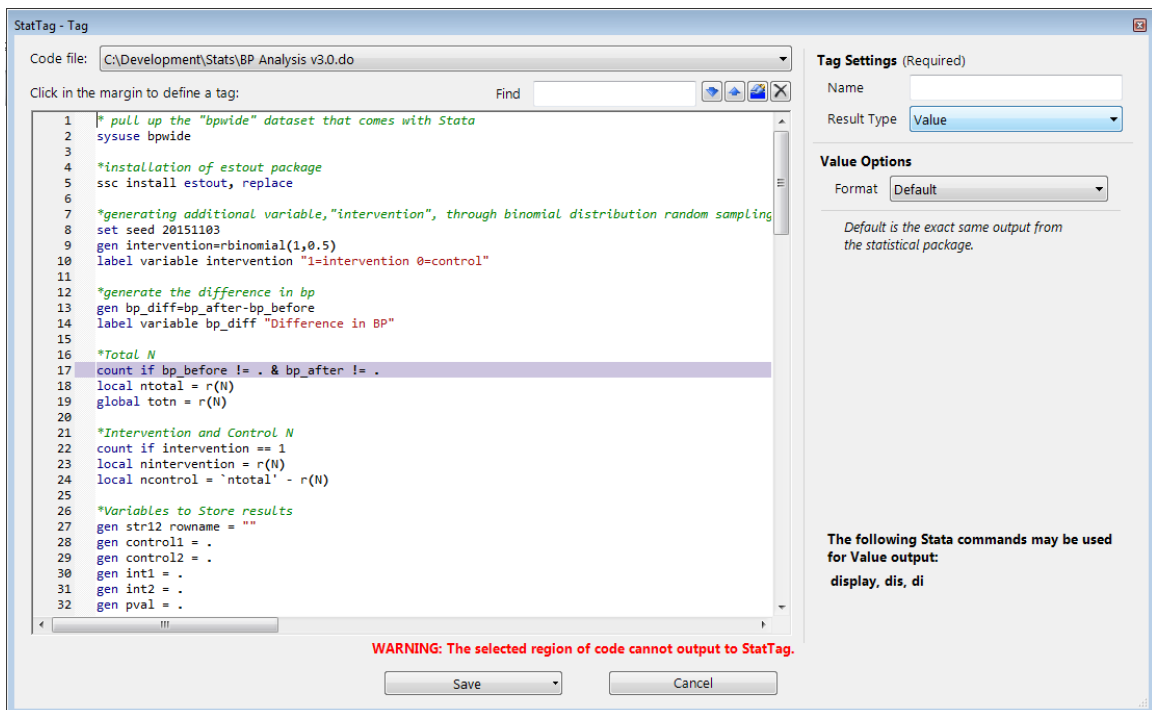
1. Click on the **Define Tag (+)** button in the Tag Manager to open the Tag Editor.
2. Highlight the line of code containing the desired line of code (i.e. for a value: `display`, `%put` or R/Python command).



Tip: To highlight, click between the line number and the start of the line of code. Clicking in this margin will highlight the line of code in purple. In the R example below, this location is outlined in red. You can sometimes select multiple lines, but as best practice, select only the line(s) containing the result of interest.



3. If your selection of code does not include a recognized keyword, StatTag will print an error in the bottom right of the text editor. This applies only to SAS and Stata code files.





Tip: If you get a warning that the section of code you have highlighted cannot output to StatTag, double check the instructions in the selection pane. These will tell you what commands you should highlight.

4. Use the formatting window to make any changes to the way in which the result is displayed. By default, the result will be displayed as it is in the statistical program. For example, our selections to `display `ntotal'`, `%put &num`, `print(nrow(esoph))`, and `print(n)` will insert these numbers to the Word document using the default formatting from Stata, SAS, R, and Python respectively.
5. Click either "Save" or "Save and Define Another". If "Save" is chosen, the tag will be saved, as will any edits to the statistical code. The Tag editor window will close, and return to the Tag Manager. If "Save and Define Another" is selected, the tag will be saved, as will any edits to the statistical code. The Tag editor window will remain open and all selections will be reset for you to define your next tag.
6. Use the "Define Tag" icon as often as needed to create tags for all of your statistical results.

Insert

Tags are inserted from the Tag Manager. Tags can be inserted more than one time within a document. Tags are always inserted at the location of the cursor, although they can be copied and pasted elsewhere once inserted.

To insert a saved tag:

1. Within the Tag Manager, select the tag of interest by clicking once on it. Clicking twice will open the tag in the Tag Editor window.
2. With the cursor in the Word file where you want the tag inserted, click 'Insert 1 Selected Tag'. This action inserts a placeholder for the tag, which consists of the tag name in brackets (e.g. "[my tag name]") in your Word document. This allows you to insert many tags without ever running the statistical code file.

Clinical Trial Enrollment Report

To date, [Total N] participants have been identified for screening. Of [#2] screened participants, [#4] participants have been randomized.

3. Insert as many tags as you wish repeating the steps above.

Clinical Trial Enrollment Report

To date, [Total N] participants have been identified for screening. Of [N Screened] screened participants, [N Randomized] participants have been randomized.



Tip: Multiple tags can be selected at one time.

- To fill in the values for the tags, within the Tag Manager, select all the tags you wish to fill in. Click *"Update X Selected Tags"*. This action executes the code file silently and returns the results within the placeholders in Word.

Clinical Trial Enrollment Report

To date, 10 participants have been identified for screening. Of 9 screened participants, 7 participants have been randomized.



Tip: Once a tag is inserted into a Word document, double clicking on the tag will open the tag window, from which you can modify the characteristics of the tag (name, when to run) or the associated statistical code.

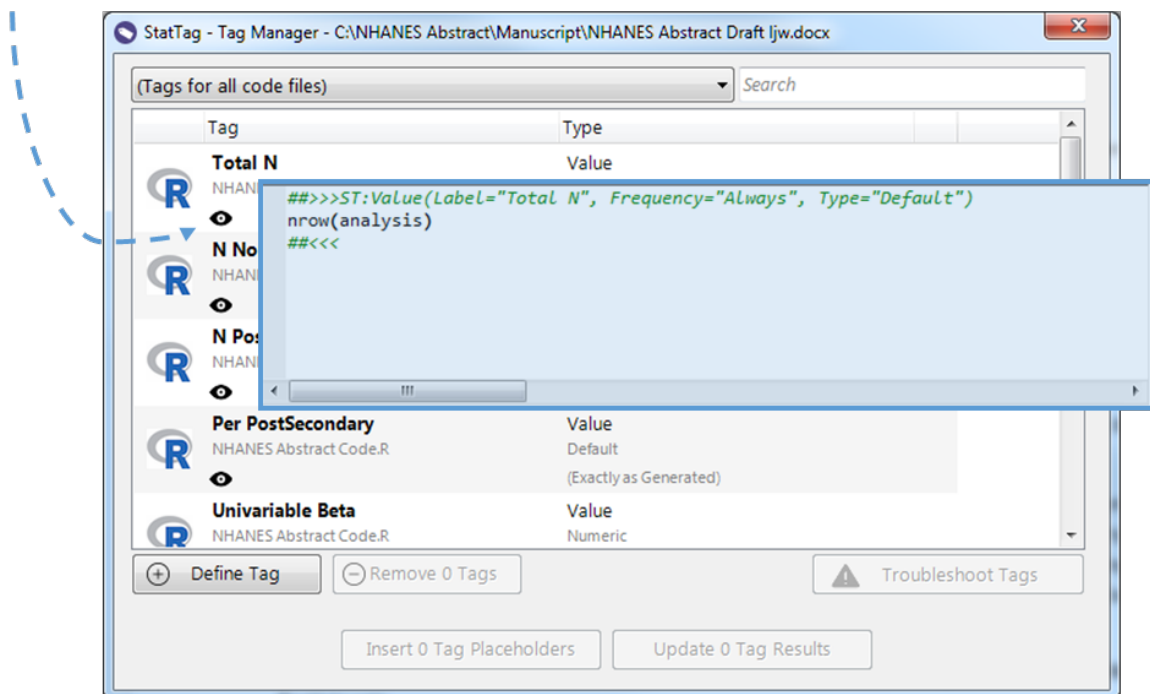
Update

Tags can be updated at any time from the Tag Manager by selecting them and clicking *"Update X Selected Tags"*.



Tip: From the Tag Manager, select the peek (👁) to quickly view the code associated with a tag without opening the Tag Editor.


Peak function



Manage

Once saved, all tags will be listed in the Tag Manager. From this dialog box, the user can change how tags are formatted and updated, or can remove them entirely.

To manage tags:

1. Click “Tags” 
2. All saved tags are depicted in the Tag Manager by their tag name with information about how they have been defined. From this dialog box, new tags can be defined, and existing tags can be edited or removed.
3. To edit a tag, double click on the tag. This opens the statistical code window, showing the highlighted tag. The options for this tag can be edited through the dialog box.



Note: Tag properties can be edited either through the dialog box using the clickable and selectable tag properties options or by editing the tag itself through either the statistical program or a text editor.

4. To remove a tag, select the tag you wish to remove. Then click “Remove 1 Tag”.



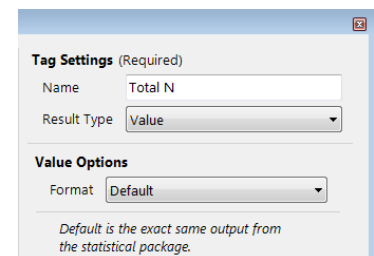
Note: Removing tags will delete the tag notation in your statistical code. Removing tags will not delete inserted text, tables or figures from your Word document. However, those results will no longer be tagged. They will not be updated when code is rerun or the document is open.

5.0 Formatting tags

When a tag is created, its format should be specified accordingly. Options may be selected for either Values or Tables. There are no formatting options for Figures or Verbatim.

5.1 Values

Values can be formatted by default (per the exact statistical output), as a number with a specific number of decimal places, as a date/time combination, or as a percentage with a specific number of decimal places. Formatting is selected from the drop-down list.



Tag Settings (Required)

Name: Total N

Result Type: Value

Value Options

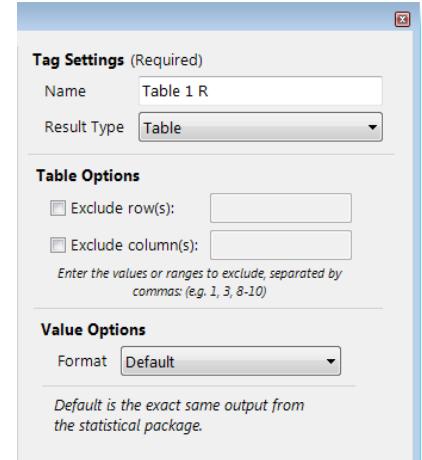
Format: Default

Default is the exact same output from the statistical package.

5.2 Tables

Matrices and tables are inserted to Word through StatTag using different mechanisms depending on the statistical software used. In all cases, data are formatted using OpenXML prior to being inserted. By default, where data are blank or missing, a “.” is returned in the particular cell. This behavior can be changed for either the document (document properties) or the user (user settings) so that the returned value is a missing character or another default character. Tables use field formatting, and text cannot currently be wrapped within a cell.

Currently, if any formatting is specified, the formatting is applied to the entire table. Formatting options include specification of the number of decimal places and inclusion of a comma separator for thousands places, which will be applied to all numerical data in the table.



Once inserted to Word, the dimensions (rows and columns) of a table should not be modified in the statistical program (e.g. removing rows or columns), as this can cause errors when updating the results. If you change the dimensions of a table in the statistical program, you should delete the table from Word and insert the table again. However, once a table is inserted, you may manually add rows/columns in Word – they StatTag allows flexibility in importing tables to exclude rows and columns by number. Using these options, the headers, row names, or specific variables and data can be excluded. However, once you’ve inserted a table in Word, you may add rows or columns in Word (e.g. a table title, a row of footnotes, or a spacing column) as long as these rows or columns do not need to contain tagged results.



Tip: Data from individual cells in an inserted table can be copied elsewhere within the Word document text, and will retain their linkage to the original data. For example, if you wished to include a p-value in the text, copy the result from the table and paste into the text. When the table is updated, the value in the text will be updated as well.

5.3 Formatting after insertion

Once inserted, values and tables can be formatted using Word text formatting options, such as changing fonts, bolding, or italicizing. Updating the tags will not affect the applied formatting in Word.

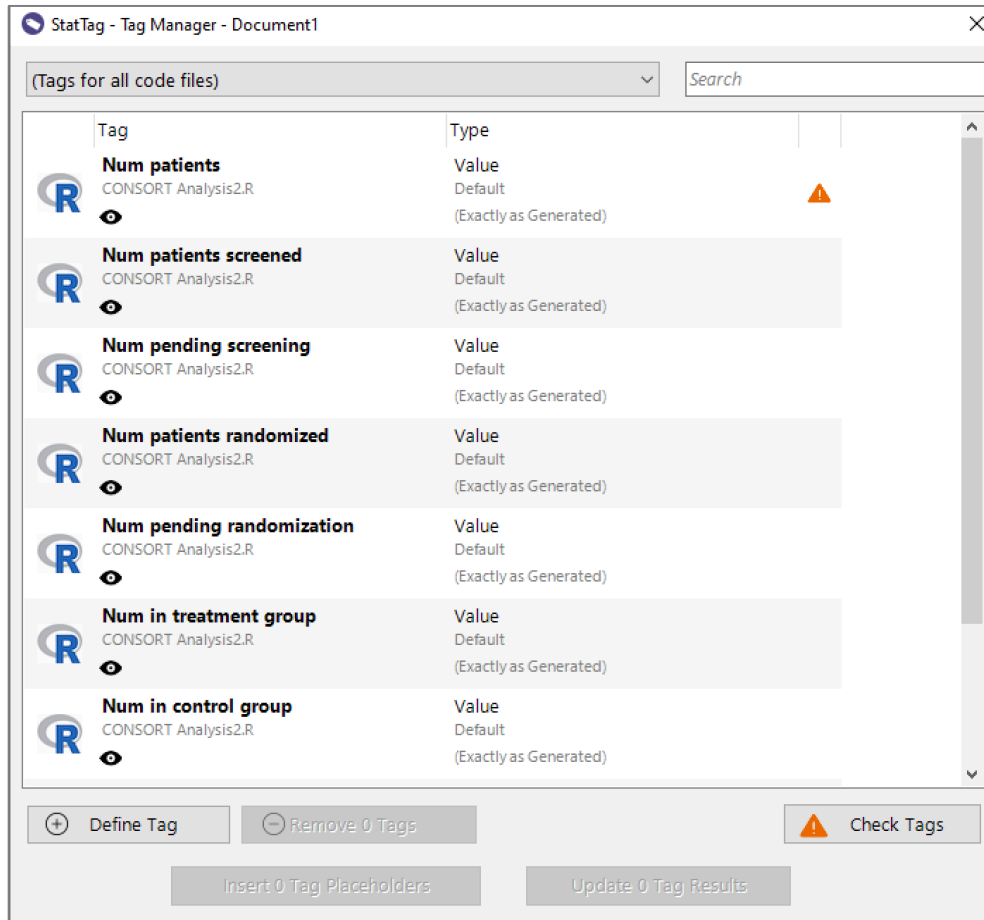
Tags can also be copy and pasted, or cut and pasted to other parts of the text, and will retain their linkage to the statistical code. If your tag is copied or inserted in multiple locations, updates within your statistical code will update every instance of the tag within your text.



Tip: Tags can be deleted from the text. Deleting the tag from the text will not delete the tag syntax within your statistical code. To delete the syntax, use the “Remove tags” option in the Manage Tags dialog box.

6.0 Troubleshooting

If there are any issues with your code or tags, the “*Check Tag*” button will alert you with the caution icon. You can use the “*Check Tag*” button at any time to have StatTag do a complete scan of your code file(s) and document.



There are three troubleshoot options provided: (1) linking unlinked tags, and (2) removing duplicate tags, and (3) removing overlapping tags.

1. Tags can become unlinked if the statistical code is unlinked from the Word document, or if the statistical code is edited outside of StatTag and the notations are modified. For example, code could become unlinked if the code file (.do, .sas or .R) is moved to new location without changing the code file path in StatTag.
2. Tag names can be duplicated within statistical code if the code is edited outside of StatTag and a tag name is inadvertently duplicated.
3. Tags can overlap if the code is edited outside of StatTag and a tag becomes embedded within another tag.

To troubleshoot any issue, click “*Check Tags*”

Unlinked Tags

Tags can become “unlinked” if the statistical code is unlinked from the Word document, or if the statistical code is edited outside of StatTag and the StatTag notations are modified. For example, code could become unlinked if the code file (.do, .sas, .R, .Rmd, or .py) is moved to new location without changing the code file path in StatTag.

Understanding Unlinked Tags

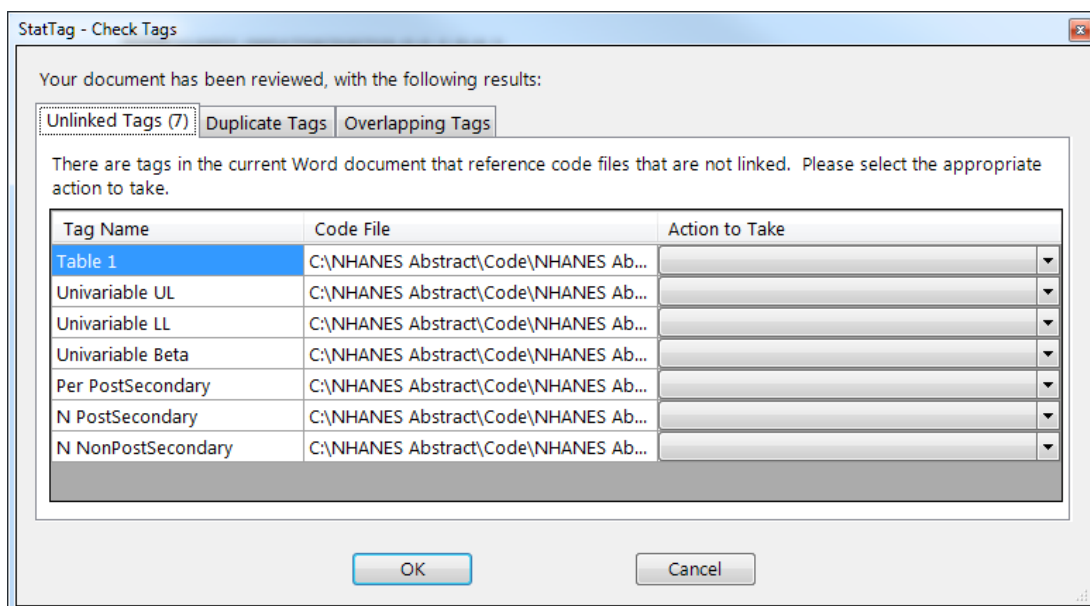
When a tag is “unlinked,” it means that StatTag can no longer connect a field from within the Word document to a tag in a code file. This presents a risk to the veracity of the document. As code files change or other findings within the document are updated, these “unlinked” tags will be frozen in time and no longer kept in sync with other findings. Additionally, unlinked tags preclude the ability to capitalize on one of the central reproducibility features of StatTag – insight into the source of the data element from the published finding. From the StatTag toolbar in Word, readers can click on a field and view the code that was used in its generation.

There are two scenarios that can lead to an Unlinked Tag

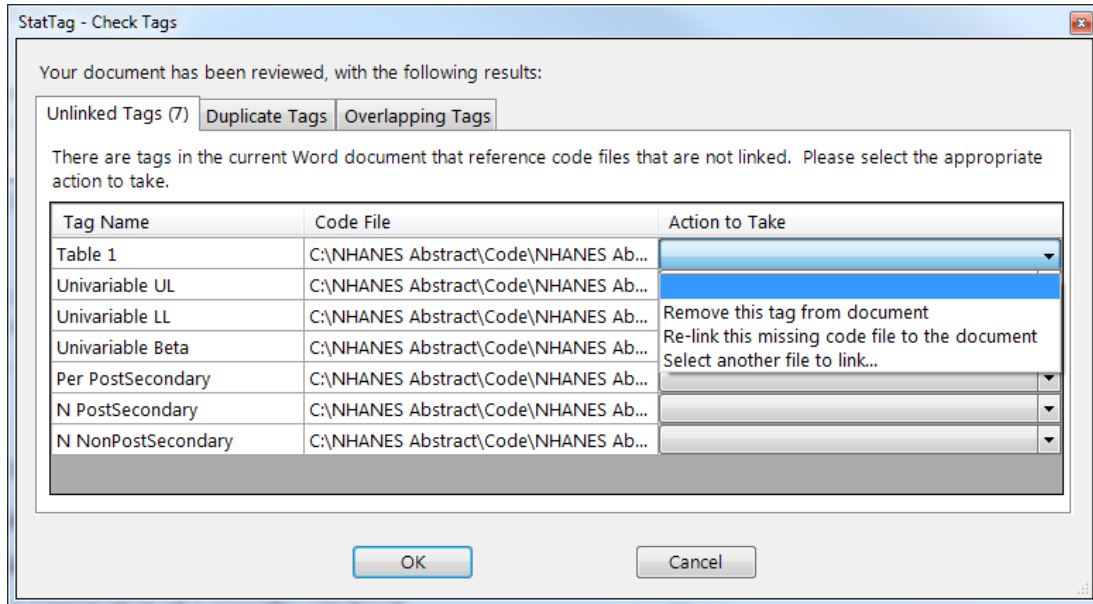
1. Inaccessible Code File
 - a. If a tag was inserted into the Word document, but the related source code file is no longer accessible, the tag is considered “unlinked” as its definition cannot be accessed
2. The tag’s definition is no longer accessible within a Code File
 - a. If a tag was inserted into the Word document, but has since been removed from a code file (or the tag name removed or changed outside of StatTag), the field in the Word document cannot be linked to a given tag

Resolving Unlinked Tags

1. If there are unlinked tags, they will be shown in the first tab.



2. The drop down menu “Action to Take” shows three options for each tag:
 - (1) Remove this tag from document
 - (2) Re-link this missing code file to the document
 - (3) Select another file to link



3. Use the drop down menu to take the appropriate action.

Duplicate Tags

StatTag relies on a tag's code file and name to create a unique identity. If two tags share the same name within the same code file, StatTag cannot differentiate them when communicating between a code file and Microsoft Word. StatTag refers to this name reuse as a “duplicate” tag.

Understanding Duplicate Tags

There are two kinds of duplicate tags:

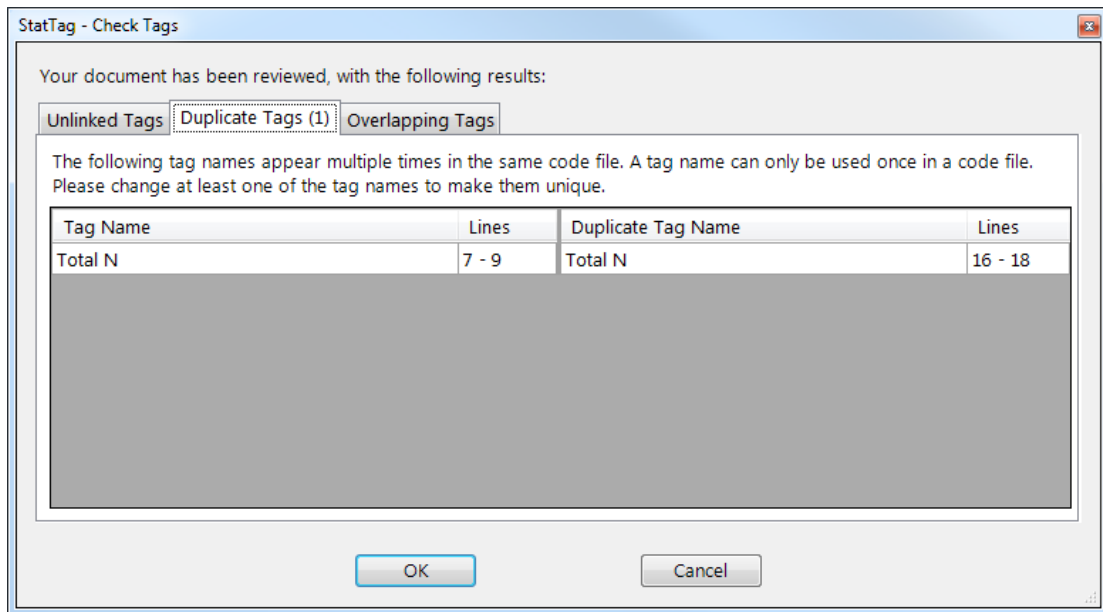
- 1) Name reused **within the same code file**.
 - a. For a single code file “my code file.do” we have
 - i. A tag named “My Important Finding” (number, linked to lines 1-10)
 - ii. A tag named “My Important Finding” (date, linked to lines 98-99)
- 2) Name reused **across separate code files**.
 - a. Code file “my code file.do” we have
 - i. A tag named “An Incredible Result” (number, percent, linked to line 25)
 - b. Code file “my other code file.do” we have
 - i. A tag named “An Incredible Result” (number, percent, linked to line 33)

Duplicate tags within the same code file must be changed. Duplicate tags within the same code file will cause an error.

Duplicate tags across two different code files are treated as warnings because they are potentially confusing. It is strongly suggested you change one of the tag names if possible.

Resolving Duplicate Tags

1. If there are duplicated tags, they will be shown in the second tab.



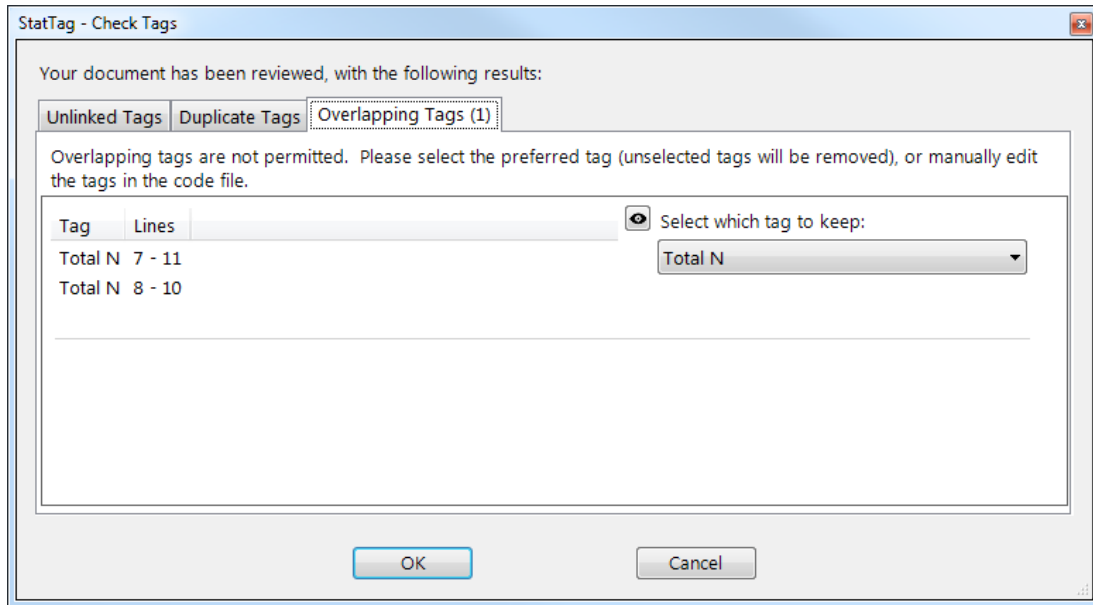
2. The dialog box shows the duplicated tags and the lines in the statistical code in which they occur.
3. Change the name of one of the tags by directly typing within this window. You may also rename or remove tags through the Tag Manager. If duplicates are not resolved, the tag output in the Word document will reflect output corresponding to the latest occurrence of the tag in the statistical code.

Overlapping Tags

StatTag doesn't allow a tag to be defined within another tag. If this occurs, StatTag cannot determine which lines of code should be run for each tag. StatTag refers to this as "overlapping" tags.

Resolving Overlapping Tags

1. If there are overlapping tags, they will be shown in the third tab.



2. Use the drop down menu to select which tag to keep. The lines that correspond to each tag are shown within the window on the left. The peek function can be used to see the associated code.

Troubleshooting Other Issues

Error	Solution
A tag displays [NO RESULT] instead of a value	<p>StatTag returns this value when the plug-in does not capture any information from the statistical program. If your tag returns this result, complete these steps:</p> <ol style="list-style-type: none"> 1. Close the statistical program if it is open. 2. Check to ensure the tag encapsulates a keyword command. 3. Check to ensure the statistical code is running correctly. Run the code in the native software and check for any errors or warnings. 4. Review any files created on disk to ensure they contain the expected output, and they are created each time the code is run.
My document takes a long time to update	Inserting and updating tables can take a long time due to the number of fields.
Could not communicate with Stata	The Stata API must be enabled to insert and update tags. Check the Settings icon to ensure that (1) the correct

pathway has been specified to your Stata.exe file, and (2) that the API has been enabled.

Could not communicate with R

StatTag locates R software through the Registry Key. If your R Software was installed by a third party (i.e. an IT administrator) then the registry key may be located under a different account.

Warning is displayed when a tag is defined

If a red warning notice is given, you have not highlighted a keyword command in your code. Check to ensure you have selected the right option of Value, Table, or Figure, and you have highlighted a section of code containing the corresponding command.

Looping

Tags must be standalone, and should not be embedded within a loop.

Embedded Tags

Tags should not encapsulate other tags.

I don't see StatTag in the Toolbar

Check in your program files to ensure StatTag is installed. If installed, check the COM Add-ins after Word is launched. To do so, from the File menu in Word, open the Options menu, then the Add-ins menu. On the bottom of the menu, under Manage, ensure COM Add-ins is selected and click 'Go'. Ensure the box for StatTag is checked and click 'OK'.

My tag from R or Python inserts but is blank

Try encapsulating your R or Python command with the "print" function. For example, summary output from a regression model may not show up as verbatim output with "summary(myModel)" as the tagged code, but "print(summary(myModel))" should work.

7.0 Acknowledgements

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StatTag was inspired in part by the Stata Automation Report project:

Lo Magno, G.L. (2013). Sar: Automatic generation of statistical reports using Stata and Microsoft Word for Windows. The Stata Journal, 13(1); 39-64.

StatTag makes use of the following open source projects (licenses in [Appendix A](#)):

- Scintilla - <http://www.scintilla.org/>
- ScintillaNET - <https://github.com/jacobslusser/ScintillaNET>
- Json.NET - <http://www.newtonsoft.com/json>
- SASHarness - <https://github.com/cjdinger/SasHarness>
 - Hemedinger, C. (2013). Create Your Own Client Apps Using SAS® Integration Technologies. SAS Global Forum 2013. Paper 003-2013.
- ScintillaNET Find&Replace - <https://github.com/Stumpii/ScintillaNET-FindReplaceDialog>
- log4net - <https://logging.apache.org/log4net/>
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You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

a) Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.

b) Accompany the Combined Work with a copy of the GNU GPL and this license document.

c) For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.

d) Do one of the following:

0) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.

1) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.

e) Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

5. Combined Libraries.

You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities, conveyed under the terms of this License.
- b) Give prominent notice with the combined library that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

6. Revised Versions of the GNU Lesser General Public License.

The Free Software Foundation may publish revised and/or new version of the GNU Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library as you received it specifies that a certain numbered version of the GNU Lesser General Public License "or any later version" applies to it, you have the option of following the terms and conditions either of that published version or of any later version published by the Free Software Foundation. If the Library as you received it does not specify a version number of the GNU Lesser General Public License, you may choose any version of the GNU Lesser General Public License ever published by the Free Software Foundation.

If the Library as you received it specifies that a proxy can decide whether future versions of the GNU Lesser General Public License shall apply, that proxy's public statement of acceptance of any version is permanent authorization for you to choose that version for the Library.

Appendix B. Frequently Asked Questions

What is StatTag?

StatTag is an [open source](#), free plug-in that integrates document preparation in Microsoft Word with statistical code, results and data. Using StatTag gives you the ability to embed statistical output in Microsoft Word documents, and edit R, R Markdown, SAS, Stata or Python code from within a Word document.

Why use StatTag?

Using StatTag will allow you to modify a dataset or analysis without transcribing and re-copying the results into a manuscript or table.

How is StatTag different than other programs for producing dynamic documents?

StatTag takes the idea of a dynamic document to the next level. Within Word you can:

- Embed statistical outputs such as estimates, tables and figures into a document
- See and edit the code behind output with one click
- Update individual or collective output with one click

How do I use StatTag?

A step-by-step guide for downloading and using StatTag is available in our User's manual – available for [macOS](#) or [Windows](#).

What software is StatTag compatible with?



Where can I get StatTag?

Click [here](#) to download the software for free.

Should I cite StatTag?

Yes. Click [here](#) for our citation.

Is StatTag free to use?

Yes. StatTag is made available under the [MIT License](#), which allows free use.

Is StatTag open source?

Yes. The source code for StatTag can be found on our GitHub page: <https://github.com/stattag>

Can I use StatTag with multiple code files?

Yes. StatTag can be used with multiple code files at the same time, and can be used with .R, .Rmd, .sas, .do, and .py files all at once.

What happens if I save a file in a different location?

StatTag saves the pathway of the code file. When the file is moved, StatTag will alert you that the file needs to be re-linked, and will direct you how to do so. Refer to section 6.0 in the Users Guides for [macOS](#) or [Windows](#).

Can I see all the Tags in a document?

Yes. Tags are highlighted when you click on them.

Can I edit my statistical code from Word?

Yes. StatTag will open your statistical code within Word in a text editing window. You can make and save changes to the statistical code from within Word. We recommend, however, that you begin with a code file that already contains your working statistical code and generates the results of interest.

I am collaborating with others on a manuscript. Who can do what? Can a collaborator without StatTag open or modify the Word document? If my collaborator works on the document, can I still edit the statistical code?

If a person has...	Then a person can...		
	Review/edit manuscript text	View code associated with a tag	Insert or update a tag
Microsoft Word	✓	✗	✗
+StatTag and code	✓	✓	✗
+StatTag and code and data	✓	✓	✓

My research team uses a mix of Mac and Windows machines. Can we all work on the same manuscript?

StatTag works seamlessly across both operating systems, and collaborators using Windows and macOS may pass files back and forth. The user, regardless of OS, will only need to re-link code files to Word documents using the StatTag user interface.

Do tags remain even as new versions of a Word document are being saved?

Yes, tagging carries over to new versions of Word documents. In fact, tags within the document are carried across different saved versions of the document, across operating systems, and across users with or without StatTag installed.

Can we still track changes and merge documents with StatTag?

Yes, results entered by StatTag will work with Microsoft Word's "Track Changes" feature, even if your collaborators aren't using StatTag. Any changes to the tags (formatting changes, deleting, updates) will show up as a change in your Word document. If you have multiple documents from collaborators, you can still use Word's merge feature to consolidate the changes.

What if I rename my files?

StatTag has built in capability for renaming or moving files. The Word document can be renamed as needed without severing connection to the accompanying code file(s). If the code file(s) are renamed or moved, StatTag will detect and facilitate re-mapping to the new code file(s) through the user interface. Refer to section 6.0 in the Users Guides for [macOS](#) or [Windows](#).

What about data security (e.g. PII, PHI)?

StatTag does not store a copy of your data or the statistical code.

Can I insert more than one tag at a time?

Yes. From the Tag Manager window press and hold the Shift key to click and select a range of tags.

How does StatTag work with R Markdown?

When using an R Markdown file, code identified for a tag must be contained within a "code chunk." Inline code is not supported by StatTag. If an R Markdown code file has the same file name and pathway as an R code file, you should rename one or the other.

When I tried to insert a tag, it showed [NO RESULT]. What do I do?

StatTag returns this value when the plug-in does not capture any information from the statistical program. This is likely a problem with the code itself. Refer to section 6.0 in the Users Guides for [macOS](#) or [Windows](#).

When I tried to insert a tag, it returned blank data. What do I do?

Run the code in the native software and check to make sure the result is created without errors. Refer to section 6.0 in the Users Guides for [macOS](#) or [Windows](#).

Why does my document take a while to update?

Inserting and updating tables can take a long time due to the number of fields.

What about loops?

Tagged code must stand alone and cannot be embedded within a loop.

Will StatTag work with my reference manager?

We have developed StatTag to work alongside any other Word add-in, including reference managers like EndNote and Zotero. We have not tested all available reference managers and appreciate feedback from users about compatibility with these programs or others.

Known issue with Mendeley

We have confirmed that StatTag will not work with Mendeley. If you add a StatTag tag (or any add-in that adds an {ADDIN} field), Mendeley will report the error “Citation/Bibliography is wrongly placed in index area, please delete citation/bibliography in index area”. Unfortunately, this is due to how Mendeley processes fields within the document and is not something that we are able to address within StatTag.

You said I need to use Jupyter for Python and R. Does this mean everything has to be written in Jupyter Notebooks?

No. StatTag makes use of the [Jupyter messaging protocol](#) to enable support for Python and R. This is the same messaging protocol that Jupyter Notebooks use but does not itself require the use of Jupyter Notebooks.

Installing R support doesn't work no matter how many times I try. What do I do?

Setting up R support via StatTag is attempting to automate several commands that you can run on your own. If the built-in R setup that StatTag provides isn't working, this may be due to issues with local security and permissions, or other system-specific differences. You can go through the following steps to replicate the setup process and see if you continue to run into issues:

1. Download and install Python: <https://www.python.org/downloads/>
2. From the command line install Jupyter:
`pip install jupyter-core jupyter-client`
3. Within your R environment (command line, R GUI, R Studio), install and configure the IRkernel:
`install.packages('IRkernel')`
`IRkernel::installspec()`

I installed StatTag, but I don't see it in the toolbar. What do I do?

Check in your program files to ensure StatTag is installed. If installed, refer to section 6.0 in the Users Guides for [macOS](#) or [Windows](#).

I need help, what should I do?

The user's guide for [macOS](#) and [Windows](#) provides step-by-step instructions for using StatTag as well as tips for troubleshooting. Video tutorials on generating and updating tags are also available. If neither of these resources offer an answer to your question, please email the StatTag team for assistance, StatTag@northwestern.edu.

Appendix C. Support for R Versions Prior to 4.3

StatTag previously supported R 3.3 through R 4.0.2, via an integration library called R.NET. Starting with R 4.0.3, technical changes to R meant that R.NET integration stopped working. The release of StatTag 7.0 changed how it integrates with R and is reestablishing support with R 4.3 and higher.

If you need to use an older version of R, there are two options available:

1. **Use an older version of StatTag (R 3.3 – R 4.0.2)**

If you are using R 3.3 through R 4.0.2, you can continue to use an older version of StatTag (through 6.0.5). These are available for download at <https://github.com/StatTag/StatTag/releases>

2. **Set up and install IRkernel from source**

The Comprehensive R Archive Network (CRAN), where R packages are downloaded from, only provide binary versions of packages for the more recent versions of R. Packages can often be used with older versions of R, or an older version of a package can be installed.

If you attempt to install IRkernel, and you get errors about a binary version being available, you will need to install the package from source. This requires you to have additional dependencies installed on your machine, [including RTools](#).

This setup differs across machines, operating systems, and versions of R, and so we are unable to provide exhaustive documentation for each user. If you attempt to get StatTag 7.0 working with a version of R prior to 4.3 and need assistance, feel free to reach out to us at StatTag@northwestern.edu and we will see how we can help.