#SASGF

VIRTUAL

SAS® GLOBAL FORUM 2021

AMERICAS | MAY 18 – 20 ASIA PACIFIC | MAY 19 – 20 EMEA | MAY 25 – 26

Open Source SAS Macros – What? Where? How?

Katja Glaß, Katja Glass Consulting

Katja is a very active PhUSE member. With her IT background and being more than 14 years in the pharmaceutical industry, she is now working as part-time consultant focusing on open source for Pharma. She hosts a portal about open-source solutions for Pharma (www.glacon.eu/portal) and is very happy to perform open-source projects or provide general guidance.

Agenda

- **Introduction**
- Licenses
- Available Solutions
- Aspects to Consider
- Summary

Introduction

Definition Open Source:

Open Source software is software that can be freely accessed, used, changed, and shared (in modified or unmodified form) by anyone.

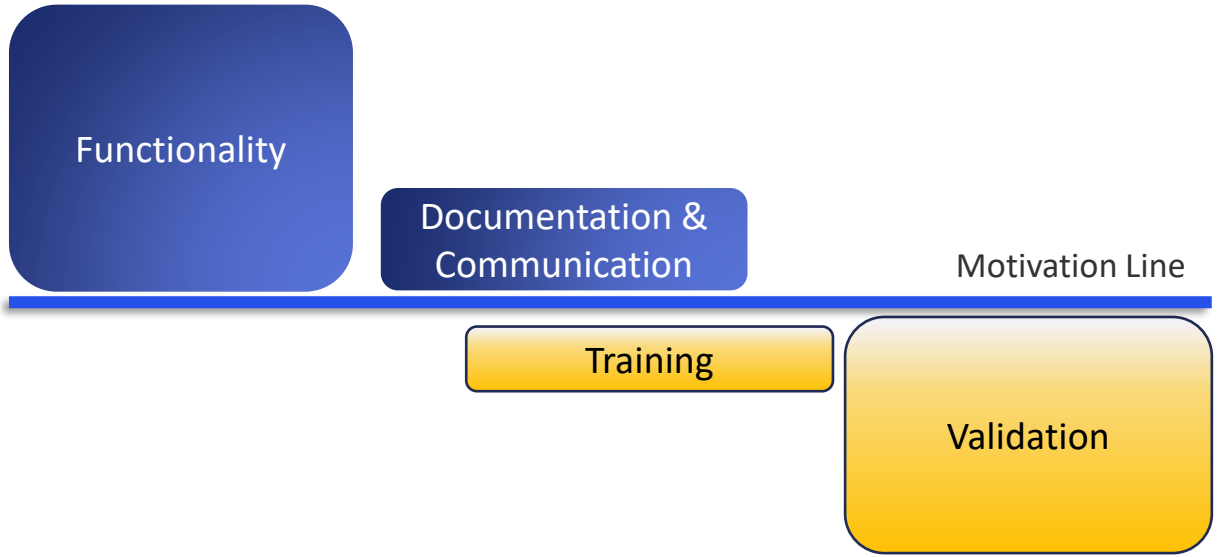
(https://opensource.org/faq#osd)

- Compared to “free” software + full transparency
- Licenses matter (how to make further use)

Introduction

Content:

- Typically no financing, personal motivation counts



Introduction

Validation:

Copy program from a colleague:

- Who is responsible for this program?
- How is validation be performed?

Copy/Use open source program:

- Same rules apply
  - Using programmer is responsible
  - Validation has to be performed

Agenda

- Introduction
- **Licenses**
- Available Solutions
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- Summary

Open Source Licenses

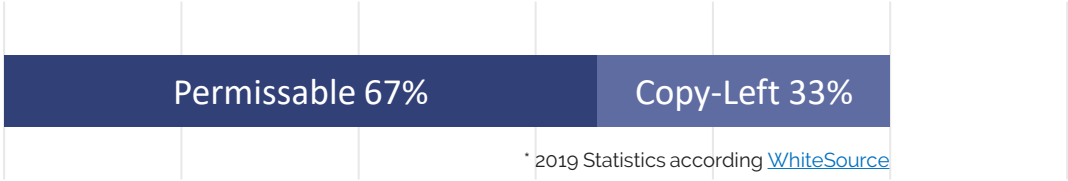
License types

Permissable

- Allows re-licensing of derived work
- Similar BY-Attribution

Copyleft

- Derives must use same license
- Similar ShareAlike



* 2019 Statistics according WhiteSource

Open Source Licenses

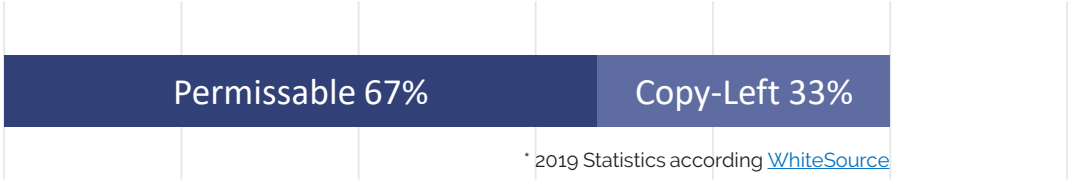
- License types

Permissable

- Use, Share, Modify
- Create proprietary versions

Copyleft

- Use, Share, Modify
- Grant “same rights” (users can use, share, modify)



* 2019 Statistics according WhiteSource

Open Source Licenses

License types

Permissable

- **MIT**
  (very short & easy)
- **Apache License 2.0**
  (more complex & detailed)
- **BSD**
  (no endorsement/promotion from copyright holders/contributors)

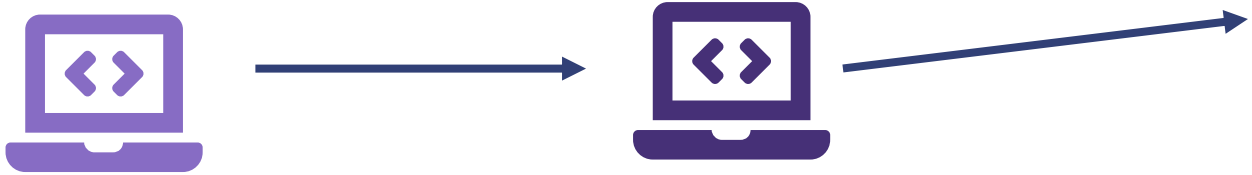
Copyleft

- **GNU-Family**
  Disclose source, license & copyright notice, state changes, same license
  - LGPL – not if used as library
  - AGPL – also if used as network software (SaaS)
  - GPL

* 2019 Statistics according WhiteSource

Open Source Licenses

Simple Usage



Flexible use of source code execution results

Open Source
MIT
GPL / AGPL / LGPL
<many others>

- Use Source and/or Software
- Modify
- Keep Acknowledgements & licenses
- **No need to publish anything, use only within company / organization**

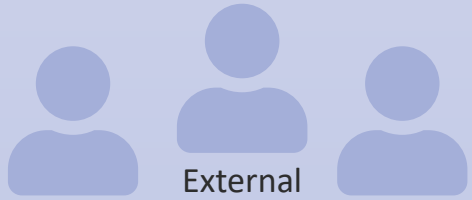
Open Source Licenses

Simple Usage

Open Source
MIT
GPL / AGPL / LGPL
<many others>

- Use Source and/or Software
- Modify
- Keep Acknowledgements & licenses

Copyleft
Rights of users
Use
Modify
Share



Academia
External
Authorities

Flexible use of source code execution results

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- **Available Solutions**
- Aspects to Consider
- Summary

Available Solutions

- What Solutions exist? How to know?
  - „Announcement“ of Open Source difficult
  - For R, search in CRAN
  - Presentations on Conferences (limited range)

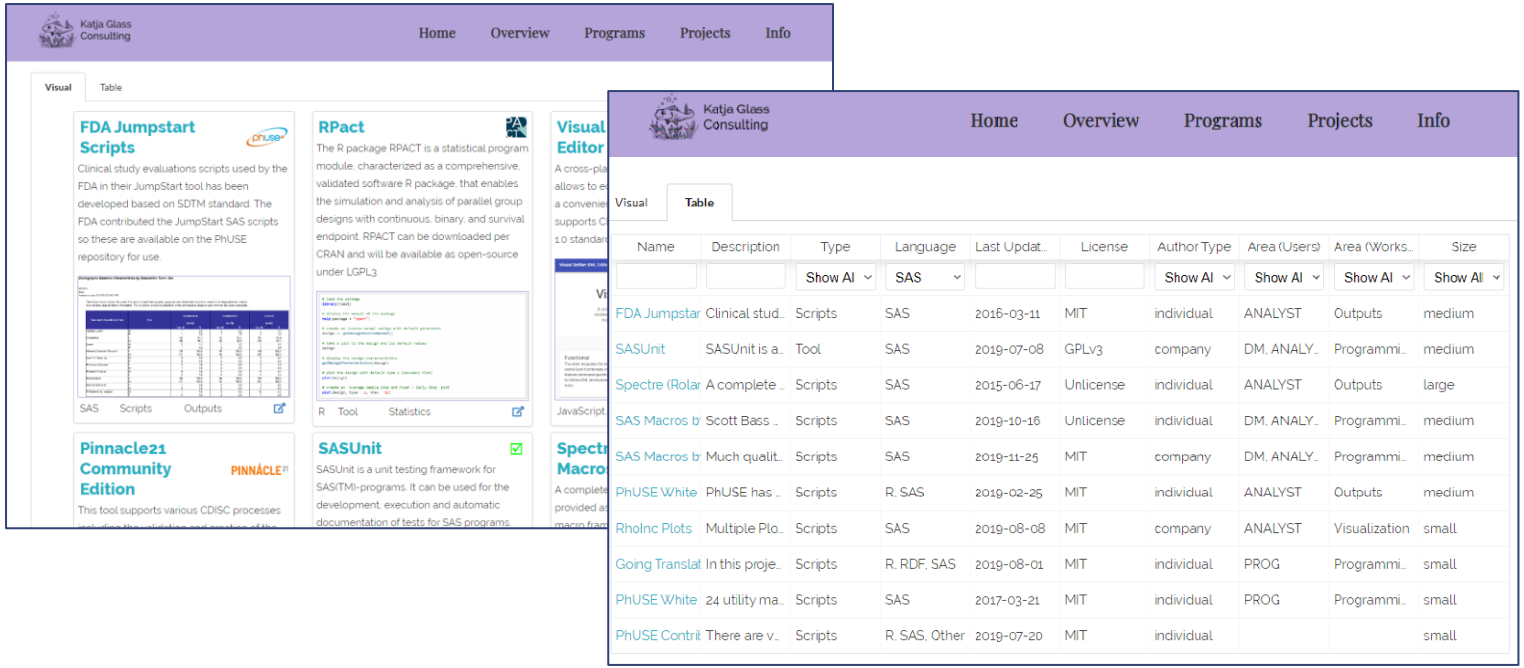
How to find Open Source?

Available Solutions

www.glacon.eu/portal (google: clinical open source portal)

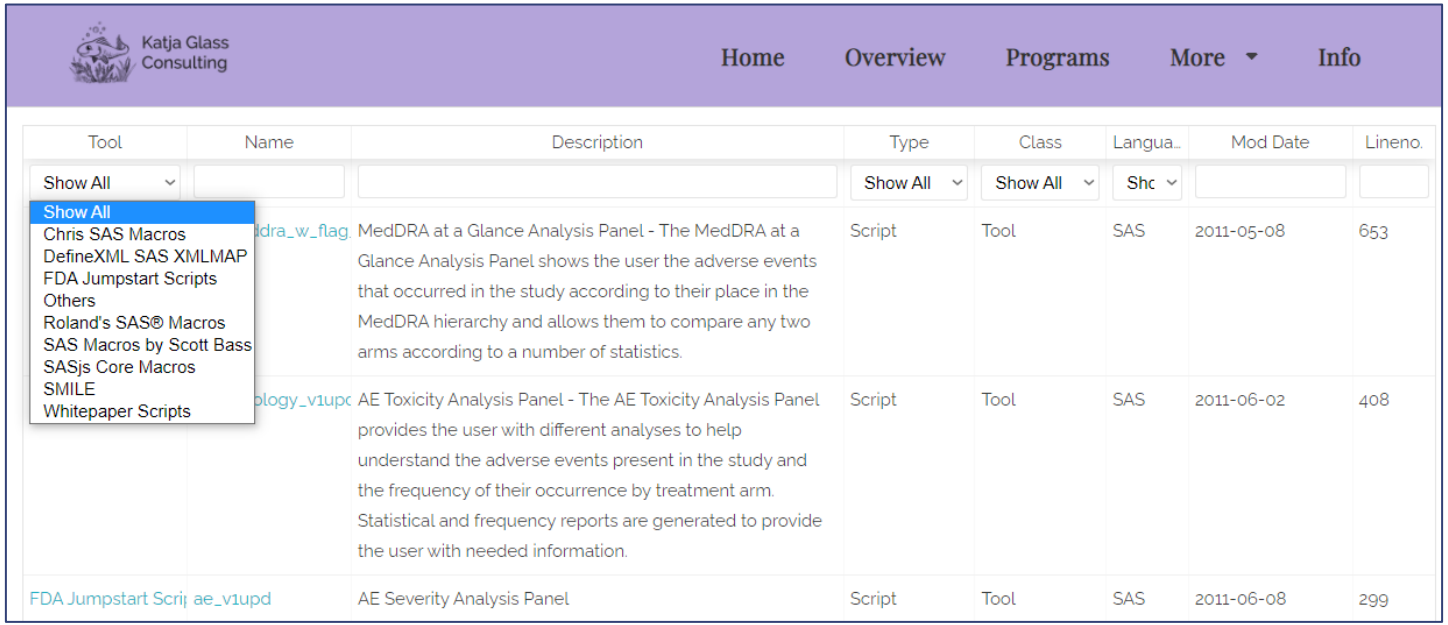
Available Solutions

- Overview -> Available Tools (www.glacon.eu/portal)



Available Solutions

- Programs -> search programs & macros (www.glacon.eu/portal)



Available Solutions

- Overview -> Filter SAS -> 17 Solutions
  - SAS Macros
    - FDA Jumpstart Scripts
    - RhoInc Plots
    - SASjs Core Macros
    - SMILE – Smart SAS Macros
    - SAS Macros by Scott Bass
    - Roland's SAS® Macros,
    - Chris's SAS Macros
    - …

(www.glacon.eu/portal)

Available Solutions

- Overview -> Filter SAS -> 17 Solutions
  - SAS Scripts
    - PhUSE White Paper Central Tendencies Scripts
    - SAS® Blog
    - DefineXML SAS XMLMAP
  - Tools
    - SASUnit
    - Reindeer – Render SAS Results into Word
    - StatTag

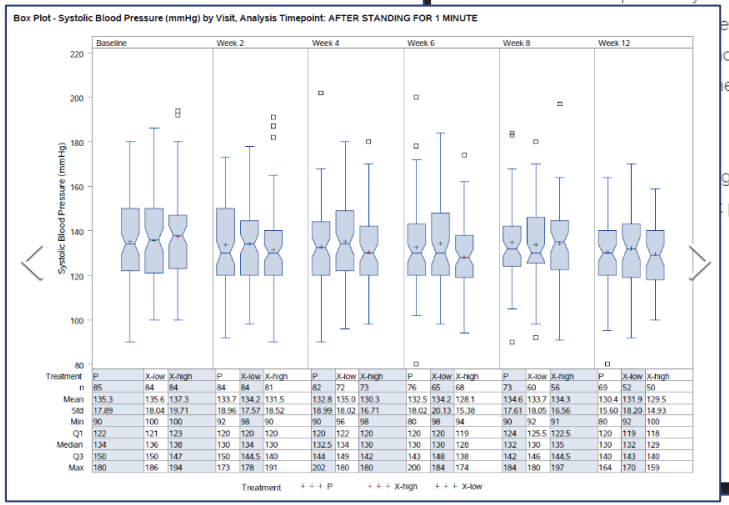
(www.glacon.eu/portal)

Agenda

- Introduction
- Licenses
- Available Solutions
  - **Scripts & Macros**
- Aspects to Consider
- Summary

PhUSE White Paper Scripts

- Programs for various tables & graphics



PhUSE White Paper Central Tendencies Scripts

Description:

PhUSE has developed analysis and display white papers covering
evaluations. Additionally people
d SAS scripts which create the white
ese scripts are made publicy available

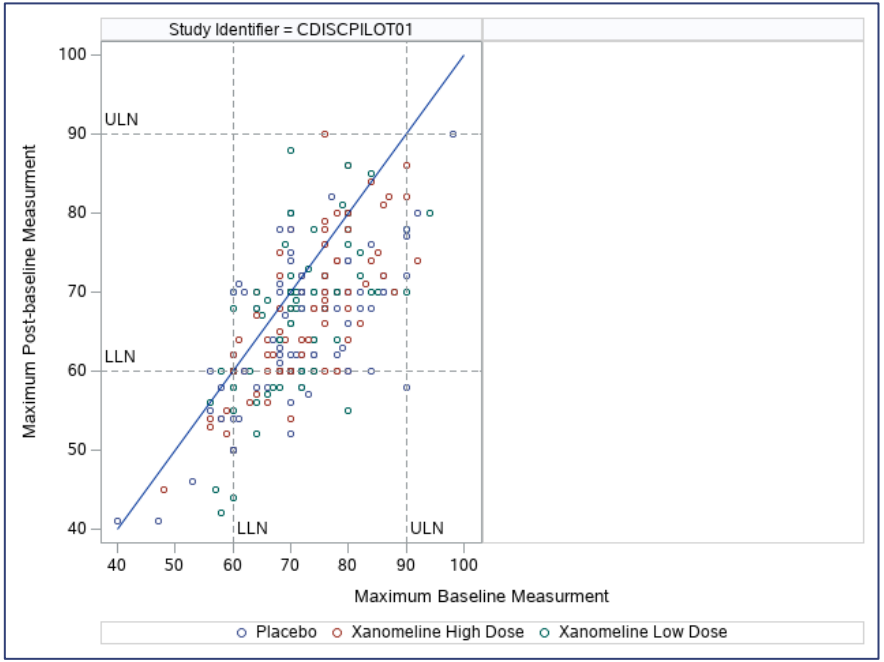
g the pilot study data available and are
programs needs adaptions when

Type	Scripts
Language	R, SAS
License	MIT
Last Update Date	2019-02-25
Link Source	https://github.com/...
Link Documentation	https://github.com/...
Documentation	Specifications and YAML (script metadata) available, documentation RShiny App can be downloaded from CRAN - R Package PhUSE
Author Type	individual
Author(s)	PhUSE Working Group
Area (Users)	ANALYST
Area (Workspace)	Outputs
Size	medium
Link Presentation(s)	https://www.lexjansen.com/...

PhUSE White Paper Scripts

- Programs for various tables & graphics

		Post-Baseline Result							
		Low		Normal		High		Total	
Treatment	Baseline Result	n	%	n	%	n	%	n	%
Placebo (N = 81)	Low	2	(2.5)	2	(2.5)	0	(0.0)	4	(4.9)
	Normal	4	(4.9)	66	(81.5)	1	(1.2)	71	(87.7)
	High	0	(0.0)	4	(4.9)	2	(2.5)	6	(7.4)
	Total	6	(7.4)	72	(88.9)	3	(3.7)	0	(0.0)
Xanomeline Low Dose (N = 72)	Low	0	(0.0)	1	(1.4)	0	(0.0)	1	(1.4)
	Normal	2	(2.8)	66	(91.7)	0	(0.0)	68	(94.4)
	High	0	(0.0)	3	(4.2)	0	(0.0)	3	(4.2)
	Total	2	(2.8)	70	(97.2)	0	(0.0)	0	(0.0)
Xanomeline High Dose (N = 73)	Low	1	(1.4)	2	(2.7)	0	(0.0)	3	(4.1)
	Normal	2	(2.7)	64	(87.7)	0	(0.0)	66	(90.4)
	High	0	(0.0)	3	(4.1)	1	(1.4)	4	(5.5)
	Total	3	(4.1)	69	(94.5)	1	(1.4)	0	(0.0)



FDA Jumpstart Scripts

- Generic clinical standard tables based on SDTM standard
- Macros creating Excel

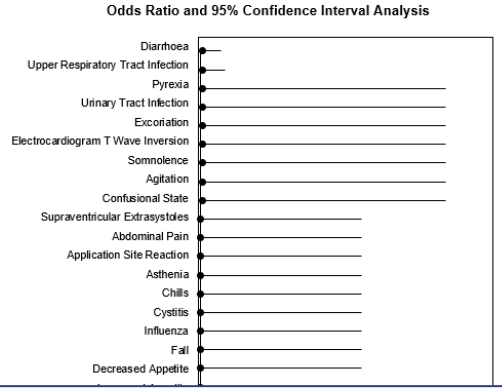
Odds Ratio & 95% Confidence Interval Analysis

Top 30 Odds Ratio Observations

NDA/BLA:
Study: CDISC
Analysis run date: 2016-03-07 11:15:12 AM

Placebo vs. Xanomeline High Dose

Body System	Dictionary-Derived Term	Placebo Count	Placebo %	Xanomeline High Dose Count	Xanomeline High Dose %	Odds Ratio	Lower 95% CI	Upper 95% CI
Gastr	Diarrhoea	9	10,5	4	4,8	2,3	(0,6,	10,8)
Infec	Upper Respiratory Tract Infec	6	7,0	3	3,6	2,0	(0,4,	12,9)
Genrl	Pyrexia	2	2,3	1	1,2	2,0	(0,1,	118,0)
Infec	Urinary Tract Infection	2	2,3	1	1,2	2,0	(0,1,	118,0)
Inj&P	Excoriation	2	2,3	1	1,2	2,0	(0,1,	118,0)
Inv	Electrocardiogram T Wave In	2	2,3	1	1,2	2,0	(0,1,	118,0)
Nerv	Somnolence	2	2,3	1	1,2	2,0	(0,1,	118,0)
Psych	Agitation	2	2,3	1	1,2	2,0	(0,1,	118,0)
Psych	Confusional State	2	2,3	1	1,2	2,0	(0,1,	118,0)
Card	Supraventricular Extrasystole	1	1,2	1	1,2	1,0	(0,0,	77,6)
Gastr	Abdominal Pain	1	1,2	1	1,2	1,0	(0,0,	77,6)
Genrl	Application Site Reaction	1	1,2	1	1,2	1,0	(0,0,	77,6)
Genrl	Asthenia	1	1,2	1	1,2	1,0	(0,0,	77,6)
Genrl	Chills	1	1,2	1	1,2	1,0	(0,0,	77,6)
Infec	Cystitis	1	1,2	1	1,2	1,0	(0,0,	77,6)
Infec	Influenza	1	1,2	1	1,2	1,0	(0,0,	77,6)
Inj&P	Fall	1	1,2	1	1,2	1,0	(0,0,	77,6)



FDA Jumpstart Scripts

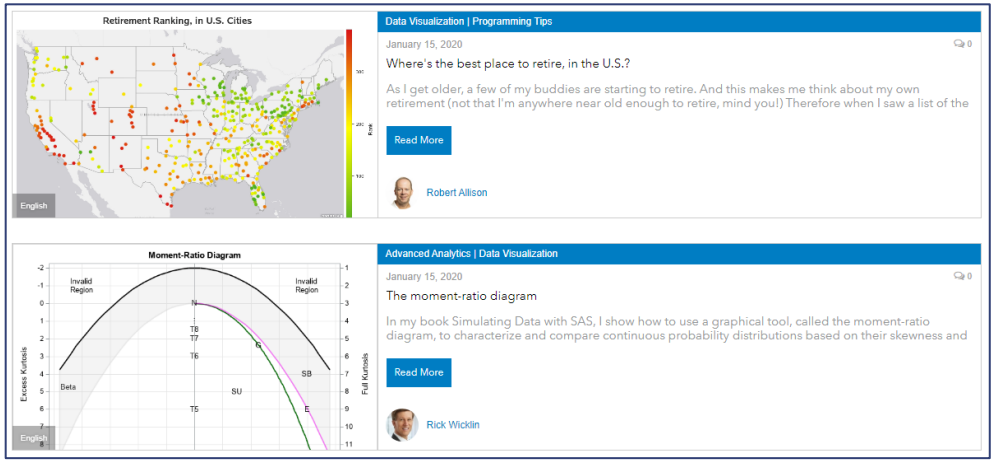
ALT Baseline / ALT Maximum	ALT < 2x ULN		2x ≤ ALT < 5x ULN		5x
	Subject Count	%	Subject Count	%	S
ALT < 2x ULN	49	98,00	0	0,00	
2x ≤ ALT < 5x ULN	**0**	**0,00**	0	0,00	
5x ≤ ALT < 10x ULN	**0**	**0,00**	**0**	**0,00**	
10x ≤ ALT < 20x ULN	**0**	**0,00**	**0**	**0,00**	
ALT ≥ 20x ULN	**0**	**0,00**	**0**	**0,00**	

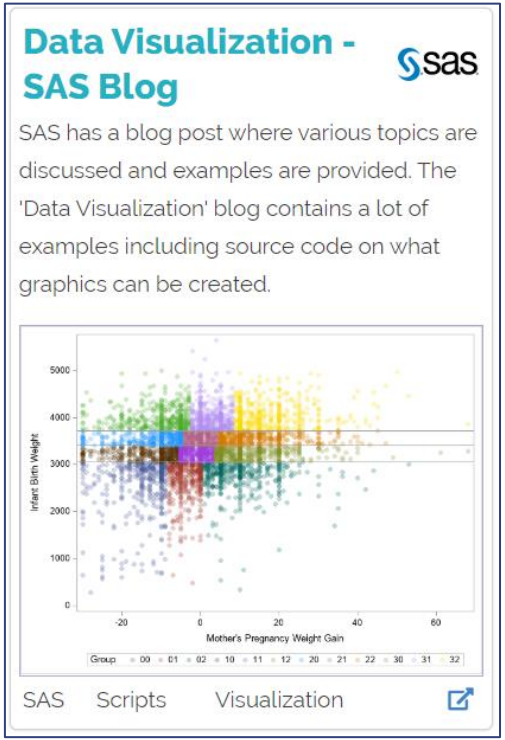
AST Baseline / AST Maximum	AST < 2x ULN		2x ≤ AST < 5x ULN		5x
	Subject Count	%	Subject Count	%	S
AST < 2x ULN	49	98,00	0	0,00	
2x ≤ AST < 5x ULN	**0**	**0,00**	0	0,00	0 0,00 0 0,00 0 0,00 **0** **0,00**
5x ≤ AST < 10x ULN	**0**	**0,00**	**0**	**0,00**	0 0,00 0 0,00 0 0,00 **0** **0,00**
10x ≤ AST < 20x ULN	**0**	**0,00**	**0**	**0,00**	**0** **0,00** 0 0,00 0 0,00 **0** **0,00**
AST ≥ 20x ULN	**0**	**0,00**	**0**	**0,00**	**0** **0,00** **0** **0,00** 0 0,00 **0** **0,00**

Demographic Baseline Characteristics		Treatment A N=302		Treatment B N=159		Overall N=461	
Age	Mean (SE)	61.8 (8.5)		60.4 (10.1)		61.3 (9.1)	
	Min	39		29		29	
	Q1	57		55		56	
	Median	61		62		61	
	Q3	68		67		68	
	Max	83		85		85	
		Count	%	Count	%	Count	%
Age Groupe	between 1 year and 35 years	0	0,0	3	1,9	3	0,7
	Age between 35 and 65	186	61,6	102	64,2	288	62,5
	Age 65 and over	116	38,4	54	34,0	170	36,9
Sex	F	128	42,4	66	41,5	194	42,1
	M	174	57,6	93	58,5	267	57,9
Race	erican Indian Or Alaska Native	2	0,7	0	0,0	2	0,4
	Asian	4	1,3	2	1,3	6	1,3
	Black Or African American	17	5,6	9	5,7	26	5,6
	Native Hawaiian Or Other Pacific Islander	1	0,3	0	0,0	1	0,2
	White	278	92,1	148	93,1	426	92,4
Ethnicity	Hispanic Or Latino	54	17,9	25	15,7	79	17,1
	Not Applicable	35	11,6	19	11,9	54	11,7
	Not Hispanic Or Latino	213	70,5	115	72,3	328	71,1

Data Visualizations – SAS Blog

- Blog by SAS®
- Descriptions & often with code
- License missing





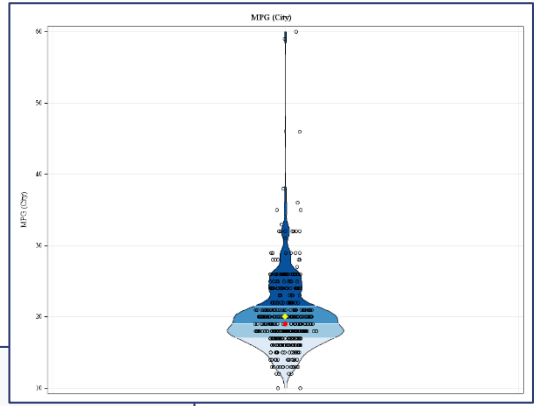
RhoInc Plots

Plug-and-play example

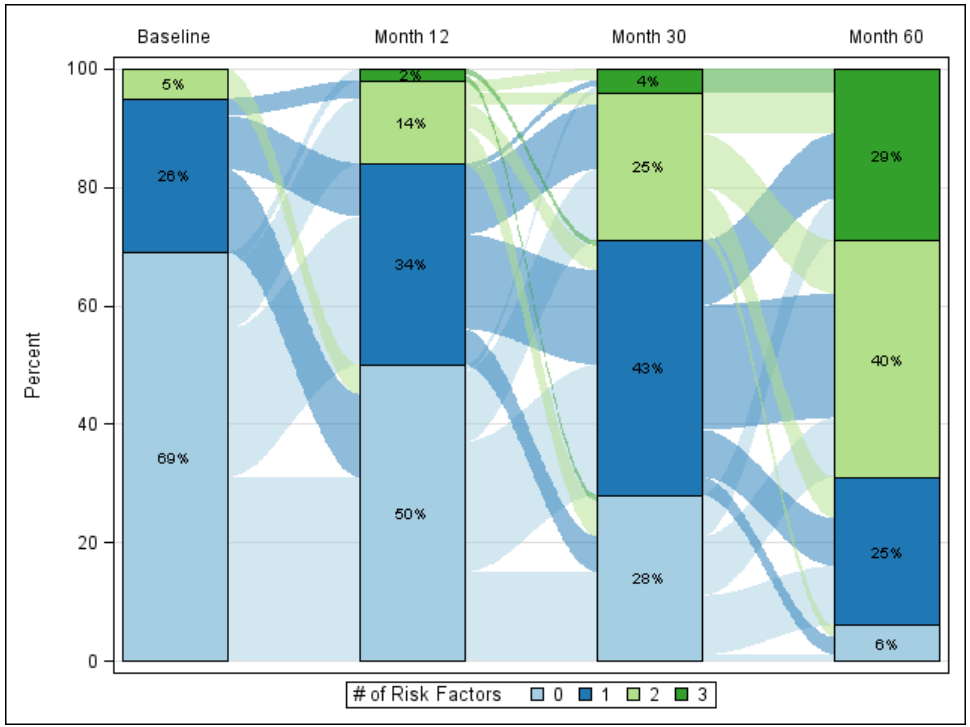
Run the code below in your local SAS session.

```
/*----------------------------------------------------------------------------------------------------
  Include %violinPlot directly from GitHub.
\----------------------------------------------------------------------------------------------------

    %let repo = https://github.com/RhoInc/sas-violinPlot;
    %let file = src/violinPlot.sas;
    %let fileURL = %sysfunc(tranwrd(%nrbquote(&repo), github.com, raw.githubusercontent.com))

    filename fileURL url "&fileURL";
        %include fileURL;
    filename fileURL;

/*--------------------------------------
  Output a violin plot of SASHELP.CARS.
\--------------------------------------

    %sysexec C:;
    %sysexec 'cd "Users\%USERNAME%"';
    ods pdf
        file = 'Violin Plot of City MPG

        %violinPlot
            (data = sashelp.cars
            ,outcomeVar = mpg_city);

    ods pdf close;
```

```
%violinPlot
    (data = sashelp.cars
    ,outcomeVar = mpg_city);
```

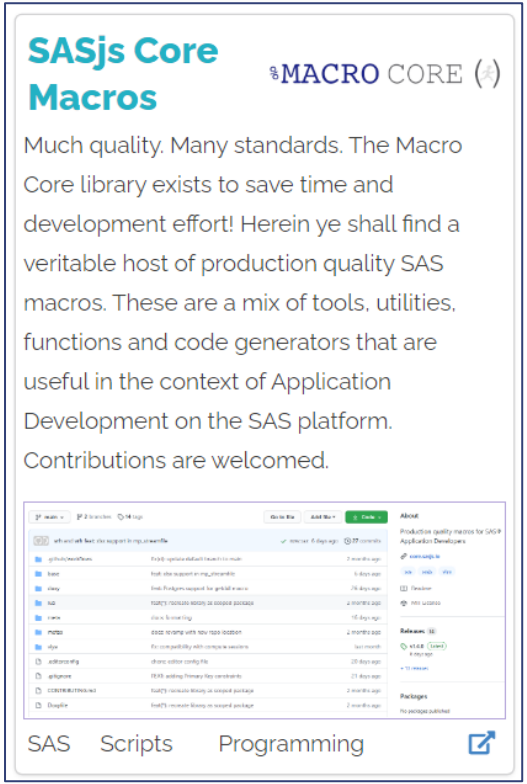


RhoInc Plots



SASjs Core Macros

- Specially developed for others
- Main maintainer: Allen Bow
- Existens-Checks
  - mf_existds (Datensatz)
  - mf_existvar (Variable)
  - mf_existvarlist (Variablen)
- Get* Informationen
  - mf_getFileSize
  - mf_getValue
  - mf_getVarType

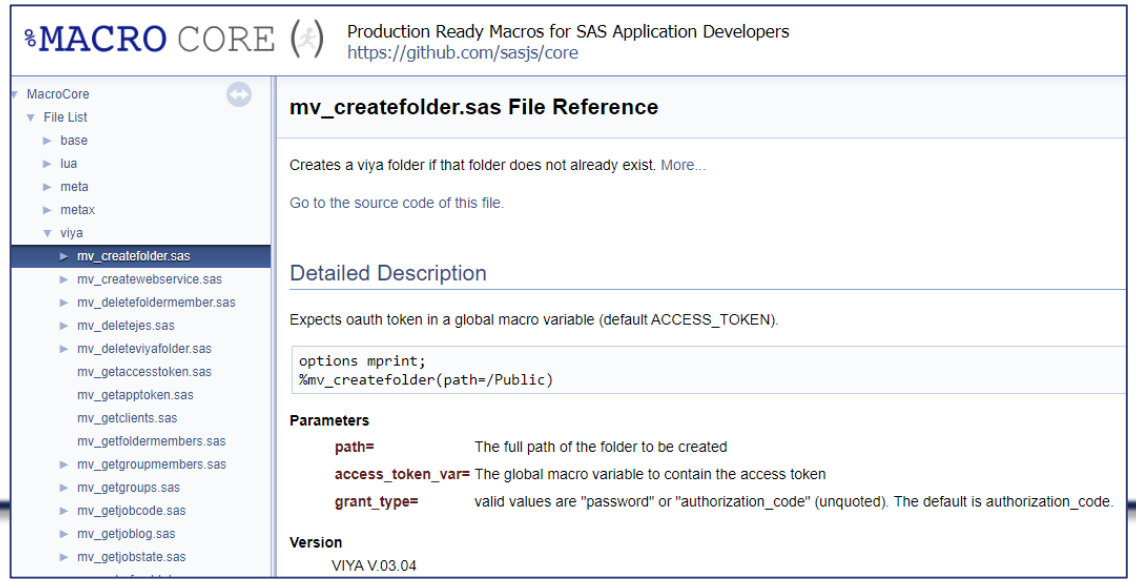


SASjs Core Macros

- mf_mkdir (Create directory)
- mp_binaryCopy (Perform binary Copy)
- mp_dirlist (List files and directories)
- mp_ds2cards (Create CARDS from data set)
- mp_searchdata (Search text in a Library)
- mp_zip / mp_unzip (Work with zip)
- ...

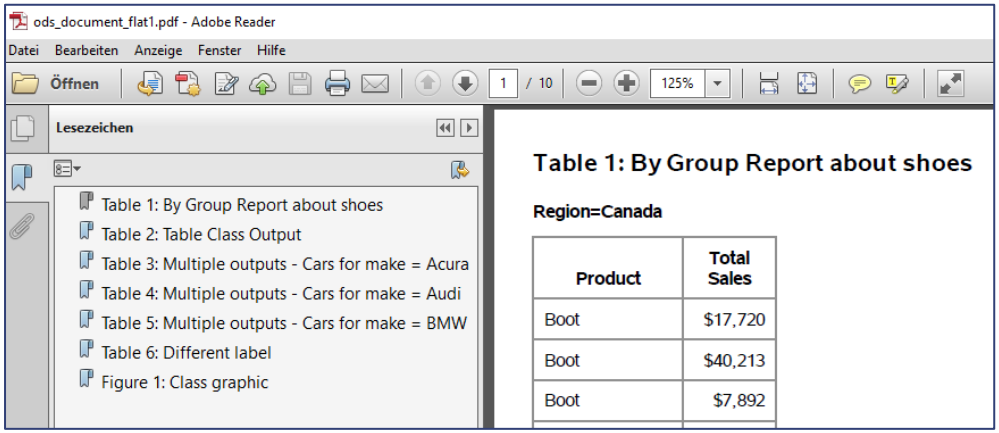
SASjs Core Macros

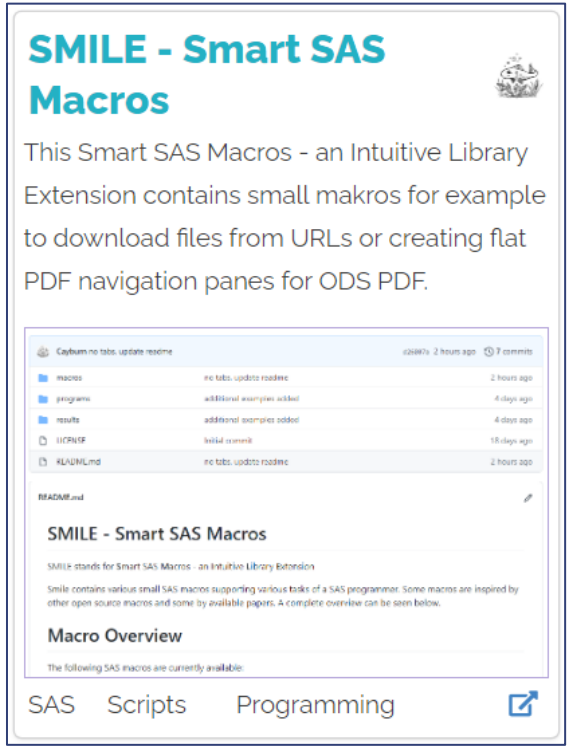
- SASjs – WebApp Framework for SAS
- Special Metadata Server Macros
- Special SAS Viya® Macros



SMILE – Smart SAS Macros

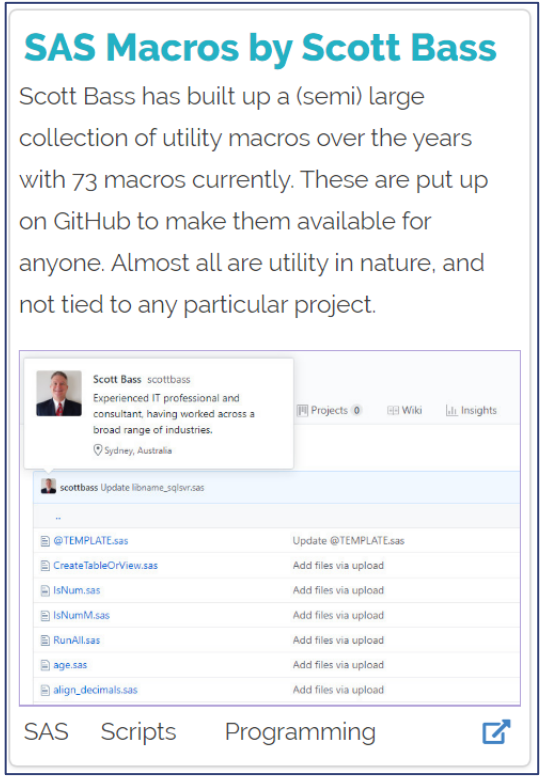
- Macros by Katja Glass Consuting
  - %smile_ods_document_flat_label
  - %smile_pdf_merge
  - %smile_pdf_read_bookmarks





SAS Macros by Scott Bass

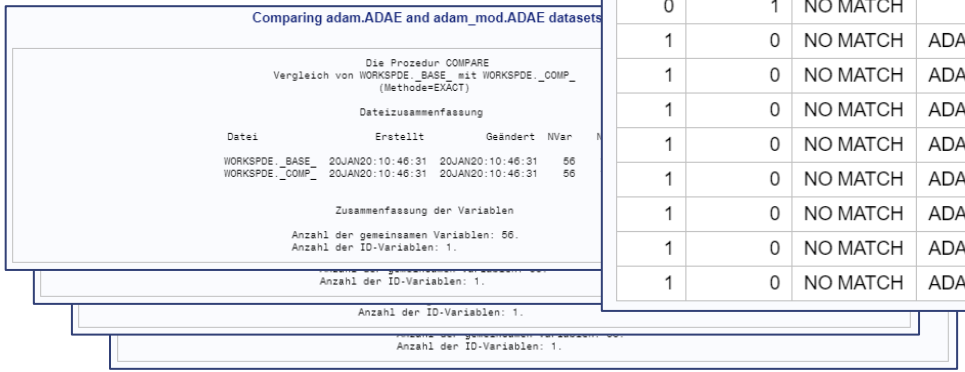
- Scott Bass, IT-SAS Consulting
  - RunAll (Asynchrony runs)
  - AlignDecimals (Decimal alignment)
  - Create_format (Format creation)
  - Delete_file (File deletion)
  - Excel2SAS (Read Excel)
  - Export_* (Export to CSV, Excel, …)
  - Logparse (Performance statistics)
  - txt2rtf (Create RTF from text)
  - …



SAS Macros by Scott Bass

- Compare (Compare datasets or libraries)

```
%compare(
    base=adam,
    comp=adam_mod,
    by=usubjid);
```

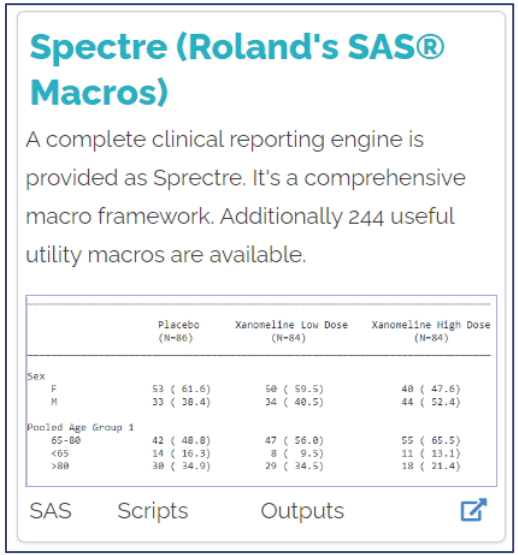


Library comparison report between adam and adam_mod libraries

Flags			Base			Compare			
Base	Compare	Matched?	Libname	Memname	# of Obs	Libname	Memname	# of Obs	Obs Diff?
1	1	MATCHED	ADAM	ADAE	1,191	ADAM_MOD	ADAE	1,191	
1	1	MATCHED	ADAM	ADSL	254	ADAM_MOD	ADSL	254	
1	1	MATCHED	ADAM	ADTTE	254	ADAM_MOD	ADTTE	241	<<<
1	1	MATCHED	ADAM	ADVS	32,139	ADAM_MOD	ADVS	32,139	
0	1	NO MATCH			.	ADAM_MOD	NEW	1	<<<
1	0	NO MATCH	ADAM	ADADAS	12,463			.	<<<
1	0	NO MATCH	ADAM	ADCIBC	730			.	<<<
1	0	NO MATCH	ADAM	ADLBC	37,132			.	<<<
1	0	NO MATCH	ADAM	ADLBCPV	37,132			.	<<<
1	0	NO MATCH	ADAM	ADLBH	24,966			.	<<<
1	0	NO MATCH	ADAM	ADLBHPV	24,966			.	<<<
1	0	NO MATCH	ADAM	ADLBHY	9,954			.	<<<
1	0	NO MATCH	ADAM	ADNPIX	31,140			.	<<<

Rolands SAS Macros

- Roland Rashleigh-Berry published many macros
- Focus own usage – less documentation
  - age (Age from Date)
  - allunique (Unique over a library)
  - char2num (Conversion)
  - combine (Combine data sets)
  - delmac (Remove macros from SASMACR)
  - dslabel (Get dataset label)
  - flatten (Reduce dataset to 1 per BY)
  - … (243 Utility Macros)



Agenda

- Introduction
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  - **Tools**
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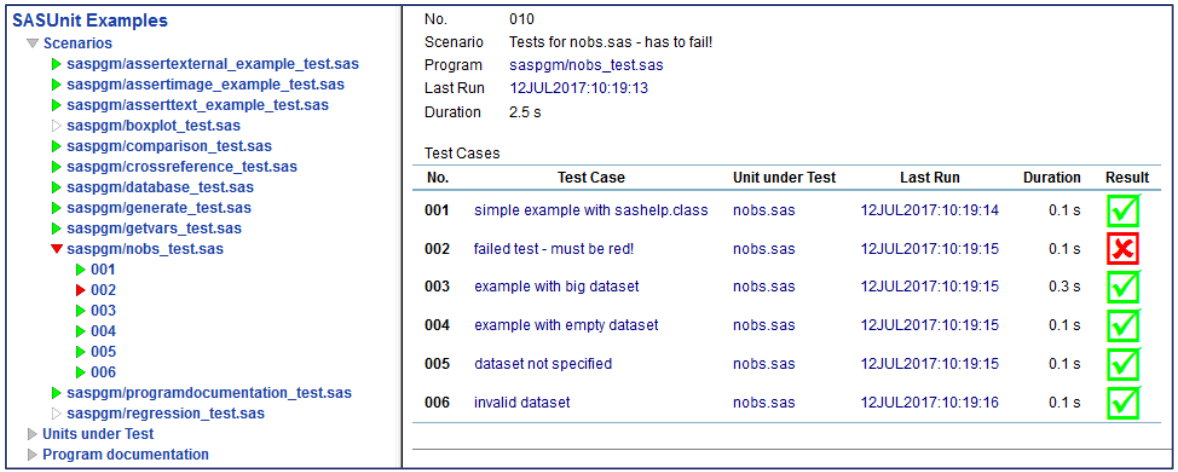
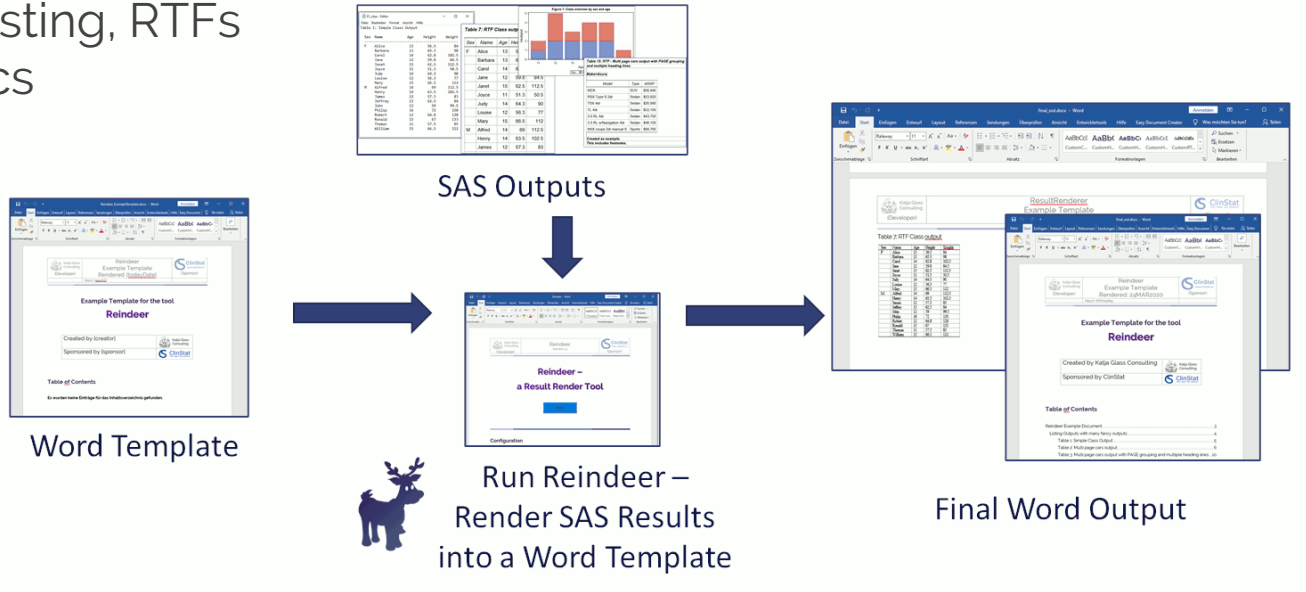
SASUnit

- Validation Framework
  - Usage more as „tool“ and less „open source“
  - High functionality & well documentation
  - For quality checks and validations



Reindeer – Render SAS Results

- VBA Macro Tool (Microsoft Word®)
  - Sponsored by ClinStat GmbH
  - Embed listing, RTFs & graphics



Reindeer – Render SAS Results

*content - Editor

Datei Bearbeiten Format Ansicht Hilfe

```
Replace;[todayDate];[todayDate]
Replace;[reportID];REPI025889
Replace;[creator];Katja Glass Consulting (2)
Replace;[sponsor];ClinStat GmbH
Header1;ResultRenderer Example Document According Content File
Header2;Listing Outputs Below
```

Katja Glass Consulting (Developer)

ResultRenderer Example Template Rendered: 14FEB2020

Table 9: RTF - Multi page cars output with PAGE grouping and multiple heading lines

Make=Acura

Model	Type	MSRP
MDX	SUV	$36,945
RSX Type S 2dr	Sedan	$23,820
TSX 4dr	Sedan	$26,990
TL 4dr	Sedan	$33,195
3.5 RL 4dr	Sedan	$43,755
3.5 RL w/Navigation 4dr	Sedan	$46,100
NSX coupe 2dr manual S	Sports	$89,765

Created as example.
This includes footnotes.

Katja Glass Consulting (Developer)

Reindeer Example Template Rendered: 14FEB2020

Report: REPI025889

ClinStat www.clinstat.eu (Sponsor)

Example Template for the tool

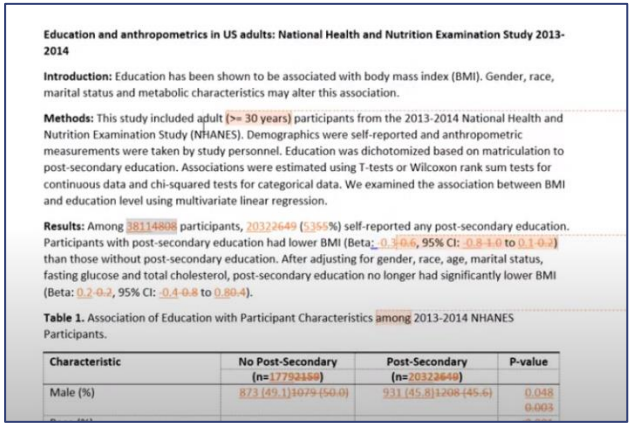
Reindeer

Created by Katja Glass Consulting	Katja Glass Consulting
Sponsored by ClinStat	ClinStat Your data. Our passion.

Table of Contents

StatTag

- Plugin for Microsoft Word®
  - Embed SAS, R or Stata code directly in Word
  - Run programs, embed results



Education and anthropometrics in US adults: National Health and Nutrition Examination Study 2013-2014

Introduction: Education has been shown to be associated with body mass index (BMI). Gender, race, marital status and metabolic characteristics may alter this association.

Methods: This study included adult (>= 30 years) participants from the 2013-2014 National Health and Nutrition Examination Study (NHANES). Demographics were self-reported and anthropometric measurements were taken by study personnel. Education was dichotomized based on matriculation to post-secondary education. Associations were estimated using T-tests or Wilcoxon rank sum tests for continuous data and chi-squared tests for categorical data. We examined the association between BMI and education level using multivariate linear regression.

Results: Among 38114808 participants, 20322649 (5355%) self-reported any post-secondary education. Participants with post-secondary education had lower BMI (Beta: -0.3 -0.6, 95% CI: -0.8 -1.0 to 0.1 -0.2) than those without post-secondary education. After adjusting for gender, race, age, marital status, fasting glucose and total cholesterol, post-secondary education no longer had significantly lower BMI (Beta: 0.2 -0.2, 95% CI: -0.4 -0.8 to 0.80.4).

Table 1. Association of Education with Participant Characteristics among 2013-2014 NHANES Participants.

Characteristic	No Post-Secondary (n=17792158)	Post-Secondary (n=20323648)	P-value
Male (%)	873 (49.1)1079 (50.0)	931 (45.8)1208 (45.6)	0.048 0.003

The StatTag Word Toolbar

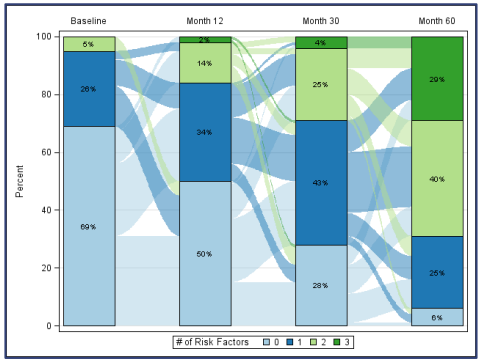
The StatTag toolbar has two groups of buttons which provide quick access to key functions

Manage Functions

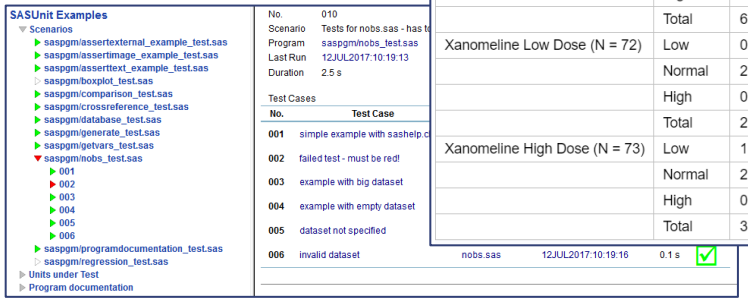
	Code Files	Opens the Code Files Manager. See “Code Files Manager” below in Section 3.3.
	Tags	Opens the Tag Manager. See “Tag Manager” below in Section 3.3.
	Document Properties	Controls default formatting behavior applied to the active document, See “Document Properties” below.

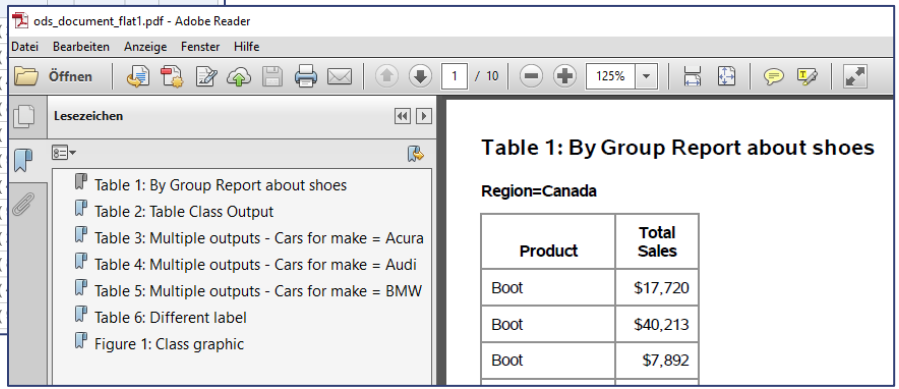
Available Solutions

- Various solutions available
- Find and use them!
- Create new Open Source



		Post-Baseline Result							
		Low		Normal		High		Total	
Treatment	Baseline Result	n	%	n	%	n	%	n	%
Placebo (N = 81)	Low	2	(2.5)	2	(				
	Normal	4	(4.9)	66	(				
	High	0	(0.0)	4	(				
	Total	6	(7.4)	72	(				
Xanomeline Low Dose (N = 72)	Low	0	(0.0)	1	(				
	Normal	2	(2.8)	66	(				
	High	0	(0.0)	3	(				
	Total	2	(2.8)	70	(				
Xanomeline High Dose (N = 73)	Low	1	(1.4)	2	(				
	Normal	2	(2.7)	64	(				
	High	0	(0.0)	3	(				
	Total	3	(4.1)	69	(				

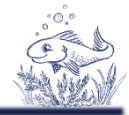




Agenda

- Introduction
- Licenses
- Available Solutions
- **Aspects to Consider**
- Summary

Aspects to Consider



- Use open source – licenses
  - Checkout license (special licenses, e.g. „non-commercial“)
  - License Overview: https://choosealicense.com/licenses/
  - Most common ones (Unlicense, MIT, GNU (LGPL, GPL, AGPL))
    - Use them right away
    - GNU: when involving third parties, share alike

- Warranty & Validation
  - Typically no warranty & validation
  - QA / Validation “in-house”

Aspects to Consider

- Challenges
  - (Creation)
  - Communication
  - Maintenance & Fixes
  - Enhancements
  - Documentation
  - Validation & Quality Control

- Challenges due to motivation

Aspects to Consider

- Enable more open source
  - Allow employees & contractors to publish open source
  - Join open collaborations
  - Invest in open source
  - Apply license to papers, blogs

- Why investments?
  - Investments enables high motivation

Aspects to Consider

- Create Open Source
  - SAS License
    - SAS® OnDemand for Academics/University edition (non-commercial)
  - Apply license
    - Recommend **MIT**, GNU
  - Store online
    - GitHub, …
  - Communication
    - Conferences
    - Social media
    - Open Source Portal

Agenda

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Summary

- High potential to simplify work life
- Solutions are available
- Clinical Open Source Portal to find them

It‘s on us to exploit the potential!

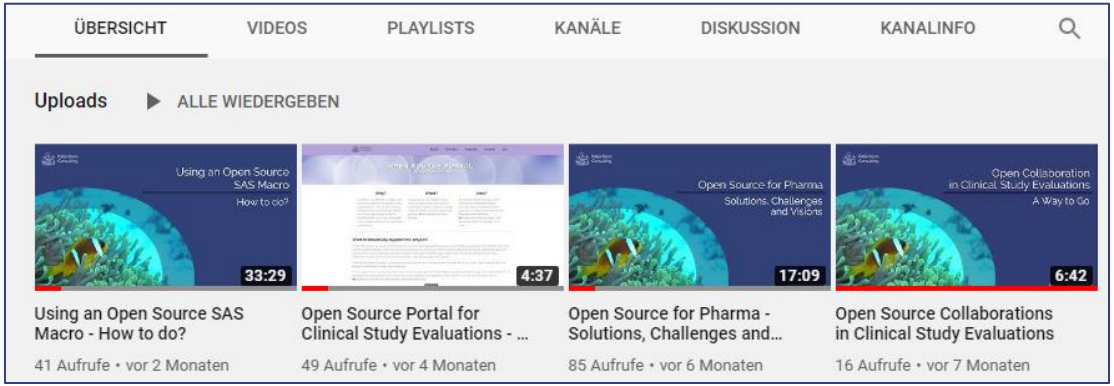
Summary

It‘s on us to enhance the potential!

- Allow employees & contractors to publish open source
- Join open collaborations
- Invest in open source

Summary

- Additional Information
  - Katja Glass Consulting @YouTube
  - Open Source Portal (www.glacon.eu/portal)
  - Open Source Guides (https://opensource.guide/)



Thank you!

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www.glacon.eu

www.glacon.eu/portal