Unraveling R logs: A Guide to Powerful and Clear Logging

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Introduction

SAS® users transitioning to R face challenges due to the lack of a built-in, standardized logging system in R.

Structured logging using R packages – logrx, logr, tidylog, whirl:

- ✓ Improves log readability
- ✓ Improves traceability, reproducibility in production and regulated environments
- ✓ Enables effective troubleshooting

Challenges

Default R Log

- ➢No native logging
- ➢Unstructured console output
- ➢Minimal scope of custom messages with base R functions

SAS® Log

- ➢Robust built-in logging
- ➢Structured logs with severity levels
- ➢Customization via system options, functions, %PUT

```
> pretbl <- adsl %>%
+   group_by(SEX, TRT01A) %>%
#dplyr function
+   count() #dplyr function
>
> tbl <- pretbl %>%
+   pivot_wider(id_cols= TRT01A,
names_from = SEX, values_from = n)
#tidyr function
>
> tbl
# A tibble: 4 × 3
# Groups:   TRT01A [4]
  TRT01A                   F     M
  <chr>                <int> <int>
1 Placebo                 53    33
2 Screen Failure          36    16
3 Xanomeline High Dose    35    37
4 Xanomeline Low Dose     55    41
>
> proc.time()
   user  system elapsed
   0.84    0.46    1.29
```

Snippet of a .Rout file

```
92          proc transpose data=pretbl
out=tbl;
93          by trt01a;
94          id sex;
95          var count;
96          run;

ERROR: Data set WORK.PRETBL is not
sorted in ascending sequence. The
current BY group has TRT01A =
Xanomeline Low Dose and the next BY
group has TRT01A = Placebo.
NOTE: The SAS System stopped
processing this step because of
errors.
NOTE: There were 5 observations read
from the data set WORK.PRETBL.
WARNING: The data set WORK.TBL may be
incomplete.  When this step was
stopped there were 0 observations and
0 variables.
NOTE: PROCEDURE TRANSPOSE used (Total
process time):
      real time      0.00 seconds
      cpu time       0.00 seconds
```

SAS® log snippet

Why we need a Log?

Programming Perspective

- ✓ Track analysis steps/execution
- ✓ Troubleshooting
- ✓ Reproducibility

Regulatory Compliance

- ✓ Documentation of R packages, environment
- ✓ Traceability

Attributes of a Powerful Log

- ✓ Environment, Session Details
- ✓ Execution Metadata
- ✓ Program Context
- ✓ Messages, Warnings, Errors
- ✓ Data Transformation Details
- ✓ Compliance info (approved packages)
- ✓ Structured, Organized Log Output

Structured R logs with logging packages

Log by	Comparison with SAS®	Usage
logr + tidylog	Like SAS® log with severity levels, Easy to track analysis steps	log_open(), log_print(), log_close()
logrx	Comprehensive log, Log structured into sections	axecute() logrxaddin
whirl	Comprehensive HTML log, Summary	run()

tidylog wrapper

```
#Load 'tidylog'
#for logging 'dplyr','tidyr' operations
library(tidylog)
```

Can be used in integration with logr, logrx and whirl

logr in-line

```
# Load 'logr' package
library(logr)

# Open the log,
enable tidylog integration
log_open(
    file_name = '<filename.log>',
    logdir= '<path>',
    autolog= TRUE)

# Program code goes here
# Write messages to log body
sep("section separator/header")
log_print(<R object to be printed>)
log_warning("User defined warning")
log_info("Informative text message")
log_error("User defined error")

# Close the log
log_close()
```

logrx wrapper

```
# Load 'logrx' package
library(logrx)

# 'logrx' function to run
an R program and create log
axecute('<path>/<program-name>.R')
```

whirl wrapper

```
# Load 'whirl' package
library(whirl)

# 'whirl' function to run
an R program and create log
run(input='<path>/<program-name>.R')
```

```
==============================================
Log Path: logrcode.log
Program Path: C:/ProgramFiles/RStudio
Working Directory:
C:/Users/R_User/Desktop/R_Poster
User Name: R_User
R Version: 4.5.2 (2025-10-31 ucrt)
Machine: x86-64
Operating System: Windows 10 x64 build 26100
Base Packages: stats graphics grDevices utils
datasets methods base
Other Packages: tidylog_1.1.0 logr_1.3.9
common_1.1.3 lubridate_1.9.4
forcats_1.0.1 stringr_1.6.0 dplyr_1.1.4
purrr_1.2.0 readr_2.1.5 tidyr_1.3.1
tibble_3.3.0 ggplot2_4.0.0 tidyverse_2.0.0
Log Start Time: 2025-12-18 07:47:51.176413
==============================================

==============================================
Prepare the data
==============================================
mutate: new variable 'TRT01A' (character) with 4
unique values and 0% NA

NOTE: Log Print Time: 2025-12-18 07:47:51.348326
NOTE: Elapsed Time: 0.147238969802856 secs

group_by: 2 grouping variables (SEX, TRT01A)

NOTE: Log Print Time:  2025-12-18 07:47:51.413951
NOTE: Elapsed Time: 0.0163288116455078 secs

count: now 8 rows and 3 columns, 2 group
variables remaining (SEX, TRT01A)

NOTE: Log Print Time:  2025-12-18
NOTE: Elapsed Time: 0.006095170974

==============================================
Create final table
==============================================

pivot_wider: reorganized (SEX, n) into (F, M)
[was 8x3, now 4x3]

NOTE: Log Print Time:  2025-12-18
NOTE: Elapsed Time: 0.0132038593292236 secs

# A tibble: 4 × 3
# Groups:   TRT01A [4]
  TRT01A             F     M
  <chr>          <int> <int>
1 Placebo           53    33
2 Screen Failure    36    16
3 Xanomeline High…  35    37
4 Xanomeline Low …  55    41

NOTE: Data frame has 4 rows and 3 columns.

NOTE: Log Print Time:  2025-12-18 07:47:51.553404
NOTE: Elapsed Time: 0.120154142379761 secs

Info: This is a test message

NOTE: Log Print Time:  2025-12-18 07:47:51.578375
NOTE: Elapsed Time: 0.00155210494995117 secs

Warning: adsl_a could not be created

NOTE: Log Print Time:  2025-12-18 07:47:51.578954
NOTE: Elapsed Time: 0.000578880310058594 secs

Error: adsl_a does not exist
==============================================
Log End Time: 2025-12-18 07:47:51.582006
Log Elapsed Time: 0 00:00:00
==============================================
```

Log Header · Separators with sep() · Log Body · autolog: dplyr operation · autolog: tidyr operation · log_print()/ put() · log_info() · log_warning() · log_error() · Log Footer

Log by logr+tidylog

```
----------------------------------------------------------
-                    logrx Metadata                      -
----------------------------------------------------------
This log was generated using logrx 0.4.0
logrx package version: 0.4.0
logrx build: CRAN (R 4.5.2)
logrx link to repository:
https://github.com/pharmaverse/logrx
----------------------------------------------------------
-                User and File Information               -
----------------------------------------------------------
User: R_User
File Name: logrxcode.R
File Path: C:/Users/R_User/Desktop/R_Poster
File HashSum: c75bcefa45777f859c8e76fde4bb1d71f8e2fa88
----------------------------------------------------------
-                    Session Information                 -
----------------------------------------------------------
─ Session info ─────────────────────────────────────────
 setting  value
 version  R version 4.5.2 (2025-10-31 ucrt)
 os       Windows 11 x64 (build 26100)
 system   x86_64, mingw32
 ui       RTerm
 language (EN)
 collate  English_India.utf8
 ctype    English_India.utf8
 tz       Asia/Calcutta
 date     2025-11-26

─ Packages ─────────────────────────────────────────────
 package      * version date (UTC) lib source
 dplyr        * 1.1.4   2023-11-17 [1] CRAN (R 4.5.2)
 logrx          0.4.0   2025-05-05 [1] CRAN (R 4.5.2)
 magrittr       2.0.4   2025-09-12 [1] CRAN (R 4.5.2)
 purrr          1.2.0   2025-11-04 [1] CRAN (R 4.5.2)
 stringr      * 1.6.0   2025-11-04 [1] CRAN (R 4.5.2)
 tibble         3.3.0   2025-06-08 [1] CRAN (R 4.5.2)
 tidyr        * 1.3.1   2024-01-24 [1] CRAN (R 4.5.2)

 [1] C:/Users/R_User/AppData/Local/R/win-library/4.5
* ── Packages attached to the search path.

─ External software ────────────────────────────────────
 setting        value
 png            1.6.50
 lapack_version 3.12.1

----------------------------------------------------------
-                  Masked Functions                      -
----------------------------------------------------------
function `plot` from {package:base} by
package:graphics
----------------------------------------------------------
-              Used Package and Functions                -
----------------------------------------------------------
{!!! NOT FOUND !!!} read_sas, read_path
{package:base} library, c, print, as.numeric, message
{package:dplyr} mutate, select, group_by, count
{package:stringr} %>%, str_c
{package:tidyr} pivot_wider
----------------------------------------------------------
-            Program Run Time Information                -
----------------------------------------------------------
Start time: 2025-11-26 16:44:03 IST
End time: 2025-11-26 16:44:04 IST
Run time: 1 seconds
----------------------------------------------------------
-                  Errors and Warnings                   -
----------------------------------------------------------
Errors:
    could not find function "read_sas"

Warnings:
    There was 1 warning in `mutate()`.
ℹ In argument: `USUBJID_new = as.numeric(USUBJID)`.
Caused by warning:
! NAs introduced by coercion
----------------------------------------------------------
-            Messages, Output, and Result                -
----------------------------------------------------------

Messages:
    Attaching package: 'dplyr'
    The following objects are masked from
'package:stats':    filter, lag
    This is a custom message inserted with message()

Output:
    # A tibble: 4 × 3
    # Groups:   TRT01A [4]
      TRT01A                   F     M
      <chr>                <int> <int>
    1 Placebo                 53    33
    2 Screen Failure          36    16
    3 Xanomeline High Dose    35    37
    4 Xanomeline Low Dose     55    41

Result:
    NULL
----------------------------------------------------------
-                  Log Output File                       -
----------------------------------------------------------
Log name: logrxcode.log
Log path: C:/Users/R_User/Desktop/R_Poster
```

Log by logrx

code.R

EXECUTION END TIME
2026-01-17T13:36:19 India Standard Time

PATH TO SCRIPT
C:/Users/R_User/Desktop/R_Poster/code.R

Summary

error

Script

```
# Load packages
library(tidyverse)

── Attaching core tidyverse pa
✓ dplyr     1.1.4     ✓ readr     2.1.5
✓ forcats   1.0.1     ✓ stringr   1.6.0
✓ ggplot2   4.0.0     ✓ tibble    3.3.0
✓ lubridate 1.9.4     ✓ tidyr     1.3.1
✓ purrr     1.2.0
── Conflicts ──────────────────
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all confli

# Read input data
dm <- pharmaversesdtm::dm

# Core Program Code
adsl <- dm %>%
  mutate(TRT01P = ARM, TRT01A = ACTARM) %>% #dplyr function
  select(USUBJID, TRT01P, TRT01A, AGE, AGEU, SEX, RACE, ETHNIC) %>% #dplyr funct
  mutate_at(c("RACE","AGEU"), str_to_title) %>% #dplyr, stringr
  mutate(ASR = str_c(AGE, SEX, RACE, sep = "/"))

pretbl <- adsl %>%
  group_by(SEX, TRT01A) %>% #dplyr function
  count() #dplyr function

tbl <- pretbl %>%
  pivot_wider(id_cols= TRT01AN, #throws an error since TRT01AN doesn't exist
              names_from = SEX,
              values_from = n) #tidyr function

Error in `pivot_wider()`:
! Can't select columns that don't exist.
✖ Column `TRT01AN` doesn't exist.

#Send messages to log
message("This is a test message")

This is a test message

warning("This is a test warning")

Warning: This is a test warning
```

Session info

Platform

Setting	Value
version	R version 4.5.2 (2025-10-31 ucrt)
os	Windows 11 x64 (build 26100)
system	x86_64, mingw32
ui	RTerm
language	(EN)
collate	English_India.utf8
ctype	English_India.utf8
tz	Asia/Calcutta
date	2026-01-17
pandoc	3.6.3 @ C:/Program Files/RStudio/resources/app/bin/quarto/bin/tools/ (via rmarkdown)
quarto	NA @ C:\PROGRA~1\RStudio\RESOUR~1\app\bin\quarto\bin\quarto.exe

R packages used directly

Package	Version	Source
knitr	1.50	CRAN (R 4.5.2)
pharmaversesdtm	1.3.1	CRAN (R 4.5.2)
rmarkdown	2.30	CRAN (R 4.5.2)
sessioninfo	1.2.3	CRAN (R 4.5.2)
tidyverse	2.0.0	CRAN (R 4.5.2)

R packages used indirectly

Environment variables

Options

Log by whirl

Key Message

Structured Logging → Enhanced R User Experience • Traceability • Reproducibility