

Automated Registry Reporting

The automatic reporting statistical system is based on the statistical programming software R [1] and the R-Markdown language made available in the software environment R-Studio [2] with additional packages.

The statistical report is fully defined in the R-Markdown file and is executed (knitted in R terminology) with parameters defining the data to be analysed and the center for that the report is to be created. Another parameter is the required language of the report as it is fully localisable into different languages. The output is a html-file easily send via email, encrypted email or even instant messaging (using the highly secure Signal-messenger) to contact persons in the clinical sites.

The glue-logic for handling the imported registry data, executing the analysis and distributing the reports is implemented using Node-Red, which is a flow-based programming system mainly used for Internet of Things applications. All of the software components run in a virtual machine hosting Ubuntu.

Reported items

The automated statistical report created once per month contains basic information about:

- the number of patients included
- the number of patients included over time (s. Figure 1)
- the distribution of gender
- the distribution of age (including a Wilcoxon-test to compare the centers – s. Figure 2).

Number of validated cases in registry per month

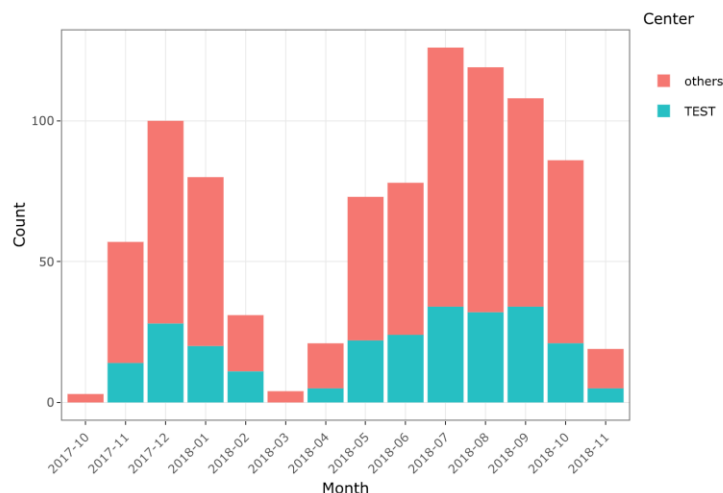
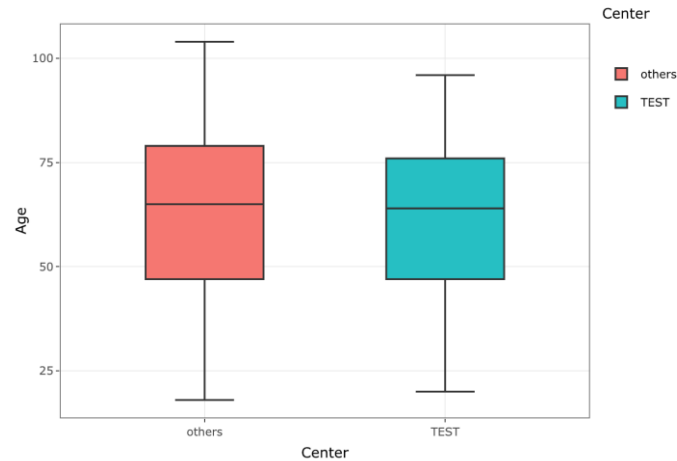


Figure 1: History of validated cases (screenshot from the report)

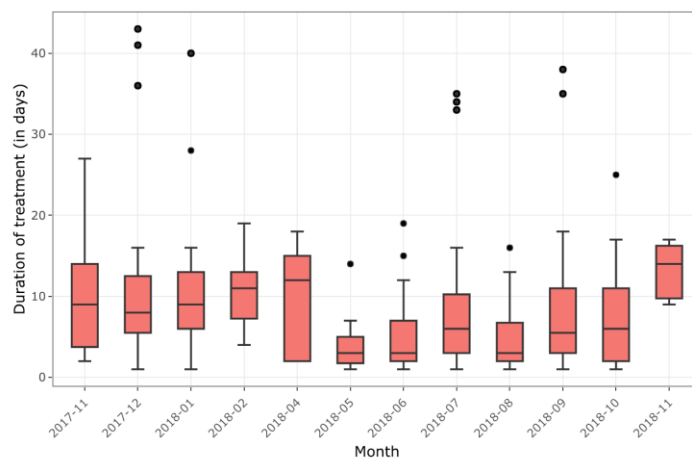


TEST Distribution of Age (at time of fracture) (median): 64 years
 others Distribution of Age (at time of fracture) (median): 65 years
 Distribution of Age (at time of fracture) - Wilcoxon rank sum test with continuity correction:
 No significant difference ($p = 0.4249$)

Figure 2: Boxplot of the age distribution (screenshot from the report)

More specific information is given on:

- the complications rate (including a Fisher-test to compare the centers)
- the severity of complication
- the history of the complication rate (including a Fisher-test to assess a significant change of your center’s complication rate in the last three months)
- the history of the complication rate (split into minor and severe complications)
- the different types of complications (as defined in the complication-classification sub-project)
- the duration of treatment (including a Wilcoxon-test to benchmark your center)
- the history of the duration of treatment (including a Wilcoxon-test to assess a significant change of your center’s complication rate in the last three months – s. Figure 3)
- the type of treatment (surgical or conservative)
- the implants used



Duration of treatment (median - last 3 months): 6.5 days
 Duration of treatment (median - previous period): 6.0 days
 Duration of treatment (last 3 months vs. previous period) - Wilcoxon rank sum test with continuity correction:
 No significant difference ($p = 0.8989$)

Figure 3: History of the duration of treatment (screenshot from the report)

A sample report in German and English is available at:

- https://www.bfcc-project.eu/files/content/Registry/BFCC_TEST_registry-report.de.html (GER)
- https://www.bfcc-project.eu/files/content/Registry/BFCC_TEST_registry-report.en.html (EN)

The plots given in the report are fully interactive: they are giving more information on mouse hover (s. Figure 4) and are zoomable.



Figure 4: Detailed data on mouse hover (screenshot from the report)