

# Using table1 with L<sup>A</sup>T<sub>E</sub>X and MS Word

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## Introduction

A long requested feature has been the ability to use `table1` in `rmarkdown` documents that render to L<sup>A</sup>T<sub>E</sub>X or `.docx` (i.e. Microsoft® Word). Since version 1.4 of `table1`, this is now possible (with some limitations) by converting the output of `table1()` to a `data.frame`, `kableExtra` or `flextable`, using the functions `as.data.frame()`, `tikable()` and `tiflex()` respectively, as these objects can be rendered to L<sup>A</sup>T<sub>E</sub>X (note: `data.frame` (via `pandoc`) and `flextable` objects can also be rendered to `.docx` format, while, `kableExtra` cannot).

## Examples

We demonstrate this using a familiar example from the main vignette. First, we can try the `data.frame` approach:

```
x <- table1(~ age + sex + wt | treat, data=dat)
as.data.frame(x)
```

##		Placebo	Treated	Overall
## 1		(N=52)	(N=94)	(N=146)
## 2	Age (years)			
## 3	Mean (SD)	39.2 (14.2)	40.1 (13.3)	39.8 (13.6)
## 4	Median [Min, Max]	37.5 [18.0, 65.0]	39.5 [18.0, 65.0]	39.0 [18.0, 65.0]
## 5	Sex			
## 6	Female	34 (65.4%)	53 (56.4%)	87 (59.6%)
## 7	Male	18 (34.6%)	41 (43.6%)	59 (40.4%)
## 8	Weight (kg)			
## 9	Mean (SD)	68.1 (16.3)	68.3 (16.7)	68.2 (16.5)
## 10	Median [Min, Max]	66.7 [37.5, 116]	64.9 [40.0, 119]	66.2 [37.5, 119]
## 11	Missing	2 (3.8%)	3 (3.2%)	5 (3.4%)

By default, this does not produce a L<sup>A</sup>T<sub>E</sub>X table, but the same text output you would see in the R console. If the `printr` package is loaded, however, we do get a L<sup>A</sup>T<sub>E</sub>X table by default:

```
library(printr, quietly=TRUE)
```

```
## Registered S3 method overwritten by 'printr':
##   method      from
##   knitr_print.data.frame rmarkdown
as.data.frame(x)
```

	Placebo	Treated	Overall
	(N=52)	(N=94)	(N=146)
Age (years)			
Mean (SD)	39.2 (14.2)	40.1 (13.3)	39.8 (13.6)
Median [Min, Max]	37.5 [18.0, 65.0]	39.5 [18.0, 65.0]	39.0 [18.0, 65.0]
Sex			
Female	34 (65.4%)	53 (56.4%)	87 (59.6%)
Male	18 (34.6%)	41 (43.6%)	59 (40.4%)
Weight (kg)			
Mean (SD)	68.1 (16.3)	68.3 (16.7)	68.2 (16.5)
Median [Min, Max]	66.7 [37.5, 116]	64.9 [40.0, 119]	66.2 [37.5, 119]
Missing	2 (3.8%)	3 (3.2%)	5 (3.4%)

Alternatively, we can use the `knitr::kable()` function:

```
kable(as.data.frame(x), booktabs=TRUE)
```

	Placebo	Treated	Overall
	(N=52)	(N=94)	(N=146)
Age (years)			
Mean (SD)	39.2 (14.2)	40.1 (13.3)	39.8 (13.6)
Median [Min, Max]	37.5 [18.0, 65.0]	39.5 [18.0, 65.0]	39.0 [18.0, 65.0]
Sex			
Female	34 (65.4%)	53 (56.4%)	87 (59.6%)
Male	18 (34.6%)	41 (43.6%)	59 (40.4%)
Weight (kg)			
Mean (SD)	68.1 (16.3)	68.3 (16.7)	68.2 (16.5)
Median [Min, Max]	66.7 [37.5, 116]	64.9 [40.0, 119]	66.2 [37.5, 119]
Missing	2 (3.8%)	3 (3.2%)	5 (3.4%)

The output here is a bit nicer because we have specified the `booktabs` option, but because we are talking about a simple `data.frame`, there is no option to specify formatting (like bold text for variable labels, for instance).

Next, we can try the `tblkable()` function, to produce a `kableExtra` object:

```
tblkable(x)
```

	Placebo	Treated	Overall
	(N=52)	(N=94)	(N=146)
<b>Age (years)</b>			
Mean (SD)	39.2 (14.2)	40.1 (13.3)	39.8 (13.6)
Median [Min, Max]	37.5 [18.0, 65.0]	39.5 [18.0, 65.0]	39.0 [18.0, 65.0]
<b>Sex</b>			
Female	34 (65.4%)	53 (56.4%)	87 (59.6%)
Male	18 (34.6%)	41 (43.6%)	59 (40.4%)
<b>Weight (kg)</b>			
Mean (SD)	68.1 (16.3)	68.3 (16.7)	68.2 (16.5)
Median [Min, Max]	66.7 [37.5, 116]	64.9 [40.0, 119]	66.2 [37.5, 119]
Missing	2 (3.8%)	3 (3.2%)	5 (3.4%)

This looks a bit better: it uses the `booktabs` option by default, and also has bold variable labels. But because of a limitation with multiline headers (i.e. headers that contain line breaks), the `N=XX` for each column is

	Placebo (N=52)	Treated (N=94)	Overall (N=146)
<b>Age (years)</b>			
Mean (SD)	39.2 (14.2)	40.1 (13.3)	39.8 (13.6)
Median [Min, Max]	37.5 [18.0, 65.0]	39.5 [18.0, 65.0]	39.0 [18.0, 65.0]
<b>Sex</b>			
Female	34 (65.4%)	53 (56.4%)	87 (59.6%)
Male	18 (34.6%)	41 (43.6%)	59 (40.4%)
<b>Weight (kg)</b>			
Mean (SD)	68.1 (16.3)	68.3 (16.7)	68.2 (16.5)
Median [Min, Max]	66.7 [37.5, 116]	64.9 [40.0, 119]	66.2 [37.5, 119]
Missing	2 (3.8%)	3 (3.2%)	5 (3.4%)

placed in the first row of the table, which is less than ideal.

Finally, we can try using the `tiflex()` function to produce a `flextable` object:

```
tiflex(x)
```

```
## Warning: Warning: fonts used in `flextable` are ignored because the `pdflatex`
## engine is used and not `xelatex` or `lualatex`. You can avoid this warning
## by using the `set_flextable_defaults(fonts_ignore=TRUE)` command or use a
## compatible engine by defining `latex_engine: xelatex` in the YAML header of the
## R Markdown document.
```

(Note that that `flextable` output, in particular the font, is different depending on whether the `xelatex`, `lualatex` or `pdflatex` engine is used, and `flextable` emits a warning when `pdflatex`, the default for `rmarkdown` documents, is used because `xelatex` and `lualatex` gives more font options.)

The output is less attractive in my opinion, and less consistent with the typical look of  $\text{\LaTeX}$  tables and documents. It is more spaced out, doesn't have bold labels or line break in the column headers (actually, this is a problem common to both packages, but the `tikable()` and `tiflex()` functions deal with it differently because `flextable` will actually include the line breaks in HTML and .docx output, and the overall best approach is unclear), and doesn't use the `booktabs` package (the thickness of the horizontal rules is different). Also, `flextable` places the table in a float, whereas `kableExtra` leaves it inline. I personally would use `kableExtra` over `flextable` in a  $\text{\LaTeX}$  documents, and in fact I have made this the default output in a  $\text{\LaTeX}$  context (i.e., when using `rmarkdown` with a  $\text{\LaTeX}$  output format). But a big advantage of `flextable` is that it can render to .docx format (i.e. Microsoft Word), which `kableExtra` cannot, and is the default output in that context.

### Nested groups

Nested groups are supported with `kableExtra` and `flextable`, but not simple `data.frames`. Here, one example with `kableExtra`:

```
x2 <- table1(~ age + wt | treat*sex, data=dat, overall=FALSE)
tikable(x2)
```

Table 2: Test caption

	Placebo	Treated	Overall
	(N=52)	(N=94)	(N=146)
<b>Age (years)</b>			
Mean (SD)	39.2 (14.2)	40.1 (13.3)	39.8 (13.6)
Median [Min, Max]	37.5 [18.0, 65.0]	39.5 [18.0, 65.0]	39.0 [18.0, 65.0]
<b>Sex</b>			
Female	34 (65.4%)	53 (56.4%)	87 (59.6%)
Male	18 (34.6%)	41 (43.6%)	59 (40.4%)
<b>Weight (kg)</b>			
Mean (SD)	68.1 (16.3)	68.3 (16.7)	68.2 (16.5)
Median [Min, Max]	66.7 [37.5, 116]	64.9 [40.0, 119]	66.2 [37.5, 119]
Missing	2 (3.8%)	3 (3.2%)	5 (3.4%)
Test footnote			

	Placebo		Treated	
	Female	Male	Female	Male
	(N=34)	(N=18)	(N=53)	(N=41)
<b>Age (years)</b>				
Mean (SD)	40.6 (14.5)	36.6 (13.6)	40.1 (13.4)	40.1 (13.3)
Median [Min, Max]	39.5 [18.0, 65.0]	33.5 [18.0, 64.0]	39.0 [18.0, 65.0]	41.0 [18.0, 65.0]
<b>Weight (kg)</b>				
Mean (SD)	68.8 (14.8)	66.8 (19.3)	65.6 (15.1)	71.5 (18.0)
Median [Min, Max]	67.2 [45.8, 116]	66.6 [37.5, 105]	61.4 [41.9, 103]	68.3 [40.0, 119]
Missing	1 (2.9%)	1 (5.6%)	3 (5.7%)	0 (0%)

### Captions and footnotes

Captions and footnotes are supported with both `kableExtra` and `flextable`. An example with `kableExtra`:

```
x <- table1(~ age + sex + wt | treat, data=dat,
  caption="Test caption", footnote="Test footnote")
t1kable(x)
```

Alternatively, the `kableExtra::footnote()` function can be used to add footnotes to the resulting object (this function also does automatic numbering, which may be considered an advantage). Note that when a caption is used, the table is rendered as a float.

## Closing remarks

As of version 1.4, it is now possible to use `table1` within  $\text{\LaTeX}$  documents. There are some limitations on the formatting, however (it looks fine, but not quite the same as the HTML output and there is less flexibility to control it).

The actual  $\text{\LaTeX}$  code generation is handled by an external package (i.e., `knitr`, `kableExtra` or `flextable`). The  $\text{\LaTeX}$  generated by `kableExtra` and `flextable` is very different, and in my opinion `kableExtra` produces the better result. Both `kableExtra` and `flextable` have an extensive number of functions that can be applied to the converted object in order to alter the appearance of the table but these will not be described here; refer to each package's documentation for the complete details.