**Supplementary material**

1. ANOVA

When performing the ANOVA test, we try to determine if the difference between the averages of the absolute residuals reflects a real difference between the groups (three analyzed groups of dialyzers), or is due to the random noise inside each group. The F statistic represents the ratio of the variance between the groups and the variance inside the groups. Unlike many other statistic tests, the smaller the F statistic the more likely the averages are equal.

Parameters:

DF: total degrees of freedom

k: Number of dialyzers (3)

n: Total number of values/treatment (3\*100= 300)

sj: Standard deviation of dialyzer j

xi: Average of dialyzer i

x: Overall average ($\frac{\sum\_{}^{}x\_{i,j}}{n}$)

SS: Sum of squares

SSbetween: The sum of squares that represents the variation among the different dialyzers

SSwithin: The sum of squares that represents the variation within one type of dialyzer

MS: mean square

MSbetween: Mean square (variance estimate) explained by the different groups of dialyzers

MSwithin: Mean square (variance estimate) within one type of dialyzers

F ratio: Represents the ratio of the variance between the groups and the variance inside the groups

P-value: Probability that measures the evidence against the null hypothesis

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| $$df\_{between}=k−1$$ | (S1) |
| $$df\_{witℎin}=n−k$$ | (S2) |
| $$SS\_{between}=\sum\_{}^{}\left[\left(s\_{j}\right)^{2}∙n\_{j}\right]−\left(\sum\_{}^{}s\_{j}\right)^{2}∙n$$ | (S3) |
| $$SS\_{witℎin}=SS\_{total}−SS\_{between}$$ | (S4) |
| $$SS\_{total}=\sum\_{}^{}x^{2}−\sum\_{}^{}x^{2}n$$ | (S5) |
| $$MS\_{between}=\frac{SS\_{between}}{df\_{between}}=\frac{SS\_{between}}{k−1}$$ | (S6) |
| $$MS\_{witℎin}=\frac{SS\_{witℎin}}{df\_{witℎin}}=\frac{SS\_{between}}{n−k}$$ | (S7) |
| $$MS\_{total}=\frac{SS\_{total}}{n−1}$$ | (S8) |
| $$F\_{ratio}=\frac{MS\_{between}}{MS\_{witℎin}}$$ | (S9) |

1. Tukey procedure for multiple comparisons

The Tukey procedure for multiple comparisons evaluates all the pairwise comparisons while controlling the family-wise error rate.

Parameters:

Honestly Significant Difference (HSD): Statistic used to determine significant differences between groups. If the absolute value of the difference between the two group’s means is greater than or equal to the HSD, the difference is significant.

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| $$HSD=q\sqrt{\frac{MS\_{within}}{n}}$$ | (S10) |

$q$: Constant found in the studentized ranged *q* table (This table is automatically generated by the software used for the analysis taking into account the degrees of freedom = 297) [1].

For this study, we obtain: $q=3.33$ and $HSD=0.3217$

Diff: Pairwise difference among dialyzers for the independent variable (average number of reuses)

$M\_{k}$: Average number of reuses of the dialyzer$ k$

Lower (lwr): Lower end point of the Tukey confidence interval

$n\_{k}$: Number of treatments for dialyzer $k$

(Should be equal for Tukey test, in our case$ n\_{i}=n\_{j}=100$)

Upper (upr): Upper end point of the Tukey confidence interval

P adj: Probability that measures the evidence against the null hypothesis after adjustments for multiple comparisons.

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| $$Diff=M\_{a}−M\_{b}$$ | (S11) |
| $$Lower (lwr)=Diff−q\sqrt{\left(\frac{MS\_{within}}{2}\right)∙\left(\frac{1}{n\_{i}}+\frac{1}{n\_{j}}\right)}$$ | (S12) |
| $$Upper \left(upr\right)=Diff+q\sqrt{\left(\frac{MS\_{within}}{2}\right)∙\left(\frac{1}{n\_{i}}+\frac{1}{n\_{j}}\right)}$$ | (S13) |

1. Shapiro-Wilks tests parameters

The Shapiro–Wilk goodness-of-fit test is used to determine if a random sample, $X\_{i}, i=1,2,…,n $is drawn from a normal Gaussian probability distribution with true mean and variance, µ and σ2, respectively. That is, $X\~N\left(μ,σ^{2}\right) $testing the hypothesis already formulated.

Parameters:

Shapiro-Wilk test statistic (W): Is a measure of how well the ordered and standardized sample quantiles fit the standard normal quantiles. The statistic will take a value between 0 and 1, 1 being a perfect match.

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| $$W=\frac{\left(\sum\_{i=1}^{n}a\_{i}x\_{(i)}\right)^{2}}{\sum\_{i=1}^{n}\left(x\_{i}−\overline{x}\right)^{2}}$$ | (S14) |

Where$ x\_{(i)}$ are the ordered sample values (in our case the ordered residuals calculated from the average number of reuses of each dialyzer) and$ a\_{i}$ are the constants generated by the expression:

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| $$\left(a\_{1}, a\_{2}, …,a\_{n}\right)=\frac{m^{T}V^{−1}}{\sqrt{m^{T}V^{−1}m}}$$ | (S15) |

With $\left(m\_{1}, m\_{2}, …,m\_{n}\right)^{T}$ being the expected values of the ordered statistics that are independent and identically distributed random variables that follow the standard normal,$ N(0,1)$ and $V$ is the covariance matrix of the order statistics. The values of $\left(a\_{1}, a\_{2}, …,a\_{n}\right) $are usually tabulated in devoted Shapiro-Wilk tables for $\left(a\_{1}, a\_{2}, …,a\_{n}\right)$ coefficients. Taking into account our sample size (100 measurements for each analyzed dialyzer), the Shapiro-Wilk coefficient, as well as p-value, was calculated using R software; however, those values can be also calculated using the origin or other software tools or even online [2].

P-value: Probability that measures the evidence against the null hypothesis after a previously selected confidence level ($∝$), in our case$ ∝ =0.05$.

1. Kolmogorov-Smirnov tests parameters

The Kolmogorov-Smirnov One-Sample test is used as a test of goodness of fit and is ideal when the size of the sample is small. It compares the cumulative distribution function for a variable with a specified distribution. The null hypothesis assumes no difference between the observed and theoretical distribution.

Parameters:

Kolmogorov-Smirnov test statistic (D): Maximum absolute difference between the two cumulative distribution functions.

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| $$D=Maximum \left|F\_{0}\left(X\right)−F\_{r}\left(X\right)\right|$$ | (S16) |

Where$ F\_{0}\left(X\right)$ is the observed cumulative frequency distribution of a random sample of n observations and $F\_{r}\left(X\right)$ is the theoretical frequency distribution.

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| $$F\_{0}\left(X\right)=\frac{G\_{i}}{T}$$ | (S17) |

For:

$G\_{i}$: Observation$ i$ from the total of observations (in our case the different calculated residuals).

$T$: Total number of observations (in our case total number of calculated residuals (100))

P-value: Probability that measures the evidence against the null hypothesis using p-value < $∝$ as rejection criteria.

A Kolmogorov-Smirnov online calculator can be found in [3].

1. Levene’s test

Levene’s test is used to test if k samples (three analyzed dialyzers) have equal variances. Equal variances across samples are called homogeneity of variance. Some statistical tests, for example, the analysis of variance, assume that variances are equal across groups or samples. Levene’s test can be used to verify that assumption.

Levene’s test works on the principle: that, a larger [variance](https://www.spss-tutorials.com/variance-what-is-it/) means that-on average-the data values are “further away” from their mean. Therefore, the absolute differences between all scores and their (group) means are computed. The means of the absolute differences should be roughly equal over groups. So technically, [Levene’s test is an ANOVA on the absolute differences](https://www.spss-tutorials.com/levenes-test-in-spss/%22%20%5Cl%20%22manual-levenes-test), and all parameters from Levene’s test are calculated using ANOVA expressions (equations S1 to S9) described above in this document [4].

1. Kruskal-Wallis tests parameters

Parameters:

Kruskal-Wallis test statistic (H): the test statistic for the Kruskal-Wallis test. Under the null hypothesis (the mean ranks of the groups are the same), the chi-square distribution approximates the distribution of H.

The approximation is reasonably accurate when no group has fewer than five observations (in our case 100 observations have been done for each group of dialyzers).

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| $$H=\left[\frac{12}{n\left(n+1\right)}\sum\_{}^{}\frac{T^{2}}{n\_{j}}\right]−3\left(n+1\right)$$ | (S18) |

Where:

$n\_{j}$: Total of measurement for each analysed dialyzer (100)

$T^{2}$: Square sum of the reuses of each group of dialyzers

P-value: is a probability that measures the evidence against the null hypothesis

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| $$correction=\frac{∝}{n}$$ | (S19) |
| $$H\_{corrected}=\frac{H}{1−correction}$$ | (S20) |

Mean (Mean): Calculated average for the reuses in each group of dialyzers.

Std (standard deviation): Calculated standard deviation for the reuses in each group of dialyzers.

Minimum: Minimum value of reuses in the group of the analyzed dialyzer.

Maximum: Maximum value of reuses in the group of the analyzed dialyzer.

Table S1: Technical data of the Low Flux Dialyzers-High Performance Steam (HPS)

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| **Low Flux Dialyzers-High Performance Steam (HPS)** | **F7 HPS** | **F8 HPS** | **F10 HPS** |
| **Ultrafiltration coefficient (ml/(h x mmHg))** | 16 | 18 | 21 |
| **Clearance: QB (300 ml/min)** |  |  |  |
| Urea | 247 | 252 | 259 |
| Creatinine | 220 | 224 | 230 |
| Phosphate | 186 | 193 | 208 |
| Vitamin B12 | 113 | 118 | 131 |
| **Clearance: QB (400 ml/min)** |  |  |  |
| Urea |  | 290 | 300 |
| Creatinine |  | 251 | 259 |
| Phosphate |  | 212 | 231 |
| Vitamin B12 |  | 124 | 139 |
| **Effective surface area (m2)** | 1.6 | 1.8 | 2.2 |
| **Blood priming volume (ml)** | 96 | 113 | 132 |
| **Membrane material** | Fresenius Polysulfone® |
| **Housing material** | Polycarbonate |
| **Potting compound**  | Polyurethane |
| **Sterilization method** | Inline Steam |
| **Form of treatment** | HD |
| **Art. No.** | 5007071 | 5007081 | 5007201 |

The in vitro performance data were obtained with QD = 500 ml/min, QF = 0 ml/min; T = 37° C (ISO8637). The ultrafiltration coefficients were maintained using human blood, Hct = 32%, protein content 6%.

**References**

1. <https://www.socscistatistics.com/pvalues/qcalculator.aspx>
2. <https://www.statskingdom.com/shapiro-wilk-test-calculator.html>.
3. <https://www.statskingdom.com/kolmogorov-smirnov-test-calculator.html>
4. <https://www.statskingdom.com/230var_levenes.html>.