

**Supplementary material 1.** Item-trait interaction formulae in Rasch measurement theory.

Müller and Kreiner describe the formulae behind the RUMM2030 analysis as follows: “The item-trait interaction is calculated using group residuals for item chi-square fit statistics as the sum of squared group residuals.” Persons are grouped into classes (g) depending on the individual scores (Formula 1).

$$X_i^2 = \sum_g Z_{gi}^2 = \sum_g \left[ \frac{\sum_{v \in g} X_{vi} - \sum_{v \in g} E(X_{vi})}{\sqrt{\sum_{v \in g} \text{Var}(X_{vi})}} \right]^2$$

The total “item-trait interaction” chi-square test statistic is the sum of item chi-square test statistic, as shown below in Formula 2.

$$X^2 = \sum_i X_i^2, df = k \cdot df_i$$

Adapted from: Müller M, Kreiner S. Item fit statistics in common software for rasch analysis. Copenhagen; 2015. Available from: [https://ifsv.sund.ku.dk/biostat/annualreport/images/2/2f/Research\\_Report\\_15-06.pdf](https://ifsv.sund.ku.dk/biostat/annualreport/images/2/2f/Research_Report_15-06.pdf).

**Supplementary material 2.** Residual correlation matrix SRS-22 domains. SRS-22r, revised Scoliosis Research Society-22.