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# PSYCHOMETRIC PROPERTIES OF THE CULIG′S QUESTIONNAIRE

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***SUMMARY***

***Background:*** *Perseverance in applying the therapy is an important determinant of its success, but evaluation of perseverance is extremely complex, and therefore, alternative method of processing the results by the Culig's questionnaire of perseverance is presented.*

***Subjects and method:*** *Psychometric properties of the questionnaire on a sample of 225 examinees have been calculated and the factor structure of indicators that make up the scale is presented.*

***Results:*** *Psychometric properties calculated in an alternative way are significantly better than the original, especially when it comes to reliability and representativeness of the questionnaire.*

***Conclusion:*** *This method of data analysis raises the possibility of multivariate data processing on the Culig's questionnaire, which is important for further research.*

***Key words:*** *perseverance - the Culig's questionnaire - psychometric properties - factor analysis*

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## INTRODUCTION

It is unnecessary to emphasize how much perseverance in applying the therapy in chronic diseases is an important determinant of its success (Dunbar-Jacob et al. 2000).

Processing the individual results of the Culig′s questionnaire is conducted (Culig & Leppée 2014, Boskovic et al. 2014), because patients' perseverance in applying the therapy is a complex phenomenon. This kind of processing is usually applied to data sets obtained by using psychological instruments, which share the complexity and indirect way of measuring (Momirovic 1982, 1983).

Raw values of each indicator, 68 of them, are processed, instead of the original 16 composite variables of the Culig′s questionnaire (Culig et al. 2011a,b). The selected method of processing individual reactions enables quantification, normalization and standardization of discrete responses to certain stimuli of questionnaire.

Answers on the individual indicators, which are on different scales, can be reduced to the standard (Z) values. Main advantage of this way of processing is that the individual indicators are considered more or less important unlike usual illogical technique that considers all indicators as equally important.

Such data processing allows to calculate the contribution of each indicator to the overall result on the scale, and it is possible to accurately show the interconnection of individual indicators, as well as their possible grouping.

The aim of study is to check the basic psychometric properties of the Culig′s questionnaire of perseverance, in which individual results are formed in an alternative way. Data were collected from the study: Adherence to medication in chronic diabetes patients (Culig et al. 2015).

## SUBJECTS AND METHODS

The Culig′s questionnaire was applied to a sample of 225 subjects, patients with type II diabetes diagnosis.

As for the vast majority of natural phenomena (Micceri 1989), it is assumed that the answers on the questionnaire are generated by a set of normally distributed variables, wherein the density function is normal distribution:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

For the standard normal distribution ($\mu=0$; $\sigma=1$) density function can be written:

$$\rho(t) = \frac{1}{\sqrt{2\pi}} \cdot e^{-\frac{1}{2}t^2}$$

and the distribution function of the standard normal distribution is:

$$\phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2} dt$$

The inverse form of the distribution function of the standard normal distribution will be marked as:

$$\eta^{-1}(\phi)$$

Normalized results of individual items of the questionnaire can be given by operation:

$$z_{cp(r)} = \eta^{-1}(\phi) \cdot cp(r)$$

where cp(r) is cummulative proportion of answers from *1 ... k*, where *k* is max number of answers.

Values are standardized as z-values (mean of 0 and standard deviation of 1) and organized in a matrix **Z**:

$$Z = \left[ z_{i,j} \right]$$

in which i= 1,... n, and j= 1, ... m, where n is number of examinees, m is number of items of the questionnaire.

Correlation matrix can be calculated as:

$$R = Z \cdot Z' \cdot n^{-1}$$

Alpha coefficient of generalizability (Cronbach et al. 1972) can be calculated as:

$$\alpha = (m \cdot (m-1)^{-1}) \cdot (1 - \lambda_1^{-1})$$

in which $\lambda_1$ is the first eigenvalue of intercorrelation matrix R. Reliability coefficient formed in that way is valid only for the results formed as a result of projection of each examinee to the first main object of the test measurements, to calculate which is necessary to form a vector:

$$y^* = v_1^* \cdot \sqrt{\lambda_1}$$

In which v* is eigenvector associated with the first eigenvalue, and the result of each respondent is calculated as a factor score on the first principal component:

$$h = z' \cdot y_1^*$$

It should be noted that the sign of each projection on the first principal component is not important. it is possible to prepare a questionnaire with answers that are oriented either way. Saturation of variables on the first principal component is also the vector of discrimination of each indicator of the scale. Additionally, factor analysis of principal components (Hotelling 1933) is conducted, with the number of factors specified by PB criterion (Štalec & Momirović 1971).

Basic idea of factor analysis is simplifying complex results, where by using a smaller number of factors we explain the large number of basic variables and connections between them, which is hard to see in the results obtained by classical statistical methods, especially with a large number of variables.

This is done so as to identify a small number of derived variables (factors), which are linear combinations of the original variables selected so that the first of them explains the largest possible share of the total variability of results; The first variable that follows explains the largest possible share of the remaining variability and so on. The factors are mutually independent (orthogonal).

Calculating stops when it reaches a predetermined criterion (usually by some rate of information contribution of each following derived variable, or occasionally by some predetermined criterion derived, for example, from the theoretical assumptions).

## RESULTS AND DISCUSSION

Questions B-J (68 discrete scale items) are processed.

Data transformation into the z values is presented in one of the questions of the questionnaire (question B-1) in table 1.

**Table 1.** Data transformation

| | Answer | p | z |
|---|---|---|---|
| 1: | „I am not sure at all“ | 0.058 | -2.234 |
| 2: | „I am mostly sure“ | 0.404 | -0.751 |
| 3: | „I am very sure“ | 0.253 | 0.275 |
| 4: | „I am certain“ | 0.284 | 1.277 |

μ=2.764; σ=0.930

Z- values of individual responses to all questions are calculated in the same way, whereby the number of possible responses was not equal (from 2 - answers yes or no to the scale of 7 degrees - the question on the frequency of alcohol consumption).

This procedure transforms all of the individual reactions in the comparable values, regardless of the number of possible answers or their orientation (higher to the lower, or vice versa) (Table 2, 3).

12 retained factors explain 58% of the total variance.

The first factor is defined by the highest number of each indicator, and is the main subject of measuring the whole scale; highest saturations are of indicators associated with perseverance in applying the therapy and with the indicators of mood of subjects, where is specified the negative impact of sad and depressed mood.

Second factor connects perseverance in applying the therapy with certain health problems with negative connection: the better the health is, the greater is the possibility of skipping therapy.

**Table 2.** Z – values

| | $z_1$ | $z_2$ | $z_3$ | $z_4$ | $z_5$ | $z_6$ | $z_7$ |
|---|---|---|---|---|---|---|---|
| B-1 | -2.23 | -0.75 | 0.28 | 1.28 | | | |
| B-2 | -2.02 | -0.63 | 0.48 | 1.52 | | | |
| C-1 | -2.58 | -1.67 | -0.38 | 1.07 | | | |
| C-2 | -1.33 | -0.27 | 0.54 | 1.50 | | | |
| D | -0.72 | 0.51 | 0.87 | 1.19 | 1.63 | 2.35 | |
| E-1 | -0.48 | 1.40 | 2.10 | 3.18 | | | |
| E-2 | -0.27 | 3.30 | 4.77 | | | | |
| E-3 | -0.62 | 0.84 | 1.52 | 2.72 | | | |
| E-4 | -0.51 | 1.19 | 1.74 | 2.79 | | | |
| E-5 | -0.31 | 2.69 | 3.77 | 5.01 | | | |
| E-6 | -0.19 | 4.93 | 6.86 | | | | |
| E-7 | -0.34 | 2.39 | 3.31 | 4.83 | | | |
| E-8 | -0.22 | 3.85 | 4.50 | 5.31 | | | |
| E-9 | -0.31 | 2.72 | 3.63 | 4.65 | | | |
| E-10 | -0.25 | 3.62 | 4.86 | | | | |
| E-11 | -0.31 | 2.66 | 3.41 | 4.40 | | | |
| E-12 | -0.41 | 1.96 | 2.99 | | | | |
| E-13 | -0.45 | 1.70 | 2.71 | | | | |
| E-14 | -0.32 | 2.48 | 3.14 | 4.35 | | | |
| E-15 | -0.25 | 3.18 | 3.82 | 5.21 | | | |
| E-16 | -0.25 | 3.34 | 4.25 | 5.64 | | | |
| F-1 | -1.24 | -0.15 | 0.83 | 1.99 | | | |
| F-2 | -0.98 | 0.12 | 0.88 | 1.89 | | | |
| F-3 | -1.09 | -0.01 | 0.90 | 2.08 | | | |
| F-4 | -1.10 | 0.03 | 0.97 | 2.10 | | | |
| G-1 | -1.62 | -0.49 | 0.61 | 1.84 | | | |
| G-2 | -2.14 | -1.18 | -0.28 | 0.95 | | | |
| G-3 | -1.91 | -0.83 | 0.30 | 1.57 | | | |
| G-4 | -1.28 | -0.18 | 0.78 | 1.85 | | | |
| H-1 | -1.14 | -0.21 | 0.45 | 1.15 | 1.93 | | |
| H-2 | -1.00 | -0.11 | 0.35 | 0.93 | 1.40 | 1.71 | 2.34 |
| I-1 | -1.44 | -0.74 | 0.03 | 1.04 | 2.05 | | |
| I-2 | -0.52 | 1.07 | 1.51 | 2.25 | 3.27 | | |
| I-3 | -0.71 | 0.46 | 0.90 | 1.65 | 2.63 | | |
| I-4 | -1.02 | -0.20 | 0.32 | 1.14 | 2.10 | | |
| I-5 | -0.88 | 0.14 | 0.80 | 1.73 | 2.57 | | |
| I-6 | -0.41 | 1.73 | 2.33 | 3.11 | 3.99 | | |
| I-7 | -0.52 | 1.16 | 1.67 | 2.39 | 3.42 | | |
| I-8 | -0.71 | 0.44 | 0.88 | 1.59 | 2.46 | | |
| I-9 | -1.12 | -0.33 | 0.29 | 1.20 | 2.13 | | |
| I-10 | -1.10 | -0.29 | 0.33 | 1.19 | 2.07 | | |
| I-11 | -0.59 | 0.87 | 1.42 | 2.21 | 3.12 | | |
| I-12 | -0.57 | 0.96 | 1.48 | 2.19 | 2.97 | | |
| I-13 | -0.87 | 0.18 | 0.82 | 1.75 | 2.72 | | |
| I-14 | -0.52 | 1.19 | 1.76 | 2.47 | 3.27 | | |
| I-15 | -0.77 | 0.36 | 0.81 | 1.40 | 2.21 | | |
| I-16 | -1.12 | -0.33 | 0.21 | 1.01 | 1.98 | | |
| I-17 | -0.63 | 0.78 | 1.27 | 1.77 | 2.46 | | |
| I-18 | -0.68 | 0.61 | 1.17 | 1.86 | 2.54 | | |
| J1-1 | -1.54 | 0.65 | | | | | |
| J1-2 | -1.01 | 0.99 | | | | | |
| J1-3 | -1.60 | 0.62 | | | | | |
| J1-4 | -0.76 | 1.31 | | | | | |
| J1-5 | -1.04 | 0.96 | | | | | |
| J1-6 | -2.18 | 0.46 | | | | | |
| J1-7 | -1.20 | 0.83 | | | | | |
| J1-8 | -1.85 | 0.54 | | | | | |
| J1-9 | -1.68 | 0.60 | | | | | |
| J1-A | -3.24 | -2.73 | -1.90 | -1.15 | 0.54 | | |
| J2-1 | -2.77 | -0.78 | 0.94 | | | | |
| J2-2 | -1.04 | 0.38 | 1.71 | | | | |
| J2-3 | -1.12 | 0.89 | | | | | |
| J2-4 | -1.12 | 0.89 | | | | | |
| J2-5 | -2.30 | -0.44 | 1.21 | | | | |
| J2-6 | -2.60 | -1.03 | 0.72 | | | | |
| J2-7 | -1.83 | -0.34 | 1.14 | | | | |
| J2-8 | -1.95 | -0.32 | 1.24 | | | | |
| J2-A | -1.68 | 0.12 | 2.01 | | | | |

**Table 3.** Factor matrix

| | $\Phi_1$ | $\Phi_2$ | $\Phi_3$ | $\Phi_4$ | $\Phi_5$ | $\Phi_6$ | $\Phi_7$ | $\Phi_8$ | $\Phi_9$ | $\Phi_{10}$ | $\Phi_{11}$ | $\Phi_{12}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 0.398 | 0.121 | 0.254 | -0.025 | 0.466 | -0.213 | -0.035 | -0.352 | 0.189 | 0.085 | -0.012 | -0.285 |
| B-2 | 0.351 | 0.244 | 0.215 | 0.055 | 0.447 | -0.308 | 0.065 | -0.333 | 0.183 | 0.080 | 0.024 | -0.228 |
| C-1 | 0.498 | 0.204 | 0.216 | 0.049 | 0.260 | -0.080 | -0.045 | -0.358 | 0.138 | -0.150 | 0.049 | -0.075 |
| C-2 | 0.103 | 0.143 | 0.148 | 0.054 | -0.063 | 0.309 | 0.131 | -0.336 | 0.135 | 0.079 | -0.085 | 0.485 |
| D | -0.353 | -0.338 | -0.129 | 0.053 | -0.009 | 0.032 | 0.496 | -0.031 | 0.320 | 0.037 | -0.153 | 0.052 |
| E-1 | -0.569 | -0.257 | 0.052 | -0.063 | 0.126 | -0.025 | 0.187 | 0.006 | 0.339 | -0.070 | -0.067 | 0.086 |
| E-2 | -0.547 | -0.265 | 0.154 | -0.193 | -0.096 | 0.048 | -0.212 | -0.005 | 0.235 | 0.035 | 0.055 | 0.092 |
| E-3 | -0.559 | -0.433 | 0.015 | 0.000 | -0.024 | -0.006 | 0.393 | 0.021 | 0.190 | -0.017 | -0.049 | -0.031 |
| E-4 | -0.671 | -0.374 | 0.055 | 0.045 | -0.025 | 0.032 | 0.248 | -0.069 | 0.087 | -0.003 | -0.046 | 0.007 |
| E-5 | -0.675 | -0.301 | 0.149 | -0.129 | 0.141 | -0.023 | 0.041 | -0.001 | -0.134 | -0.020 | 0.123 | 0.079 |
| E-6 | -0.465 | -0.371 | 0.300 | -0.114 | -0.065 | -0.053 | -0.253 | -0.033 | -0.141 | 0.026 | -0.032 | 0.040 |
| E-7 | -0.579 | -0.321 | 0.215 | -0.035 | -0.165 | 0.059 | 0.012 | 0.003 | -0.002 | 0.100 | -0.008 | -0.070 |
| E-8 | -0.544 | -0.341 | 0.155 | -0.194 | 0.089 | -0.056 | -0.100 | -0.026 | -0.179 | -0.063 | 0.079 | -0.126 |
| E-9 | -0.719 | -0.327 | 0.329 | -0.096 | 0.028 | 0.034 | -0.066 | 0.035 | -0.022 | -0.093 | -0.053 | 0.024 |
| E-10 | -0.620 | -0.261 | 0.231 | -0.181 | 0.066 | 0.033 | -0.187 | 0.011 | -0.110 | -0.169 | -0.128 | -0.089 |
| E-11 | -0.721 | -0.340 | 0.260 | -0.135 | 0.088 | 0.037 | -0.072 | 0.009 | -0.048 | -0.069 | -0.028 | -0.153 |
| E-12 | -0.733 | -0.341 | 0.198 | -0.056 | 0.104 | -0.010 | 0.212 | -0.035 | 0.060 | -0.055 | 0.041 | -0.121 |
| E-13 | -0,561 | -0.414 | 0.068 | 0.164 | -0.030 | 0.085 | 0.100 | -0.049 | 0.008 | 0.140 | -0.031 | 0.068 |
| E-14 | -0.608 | -0.215 | 0.194 | -0.117 | 0.204 | 0.007 | -0.062 | -0.093 | -0.095 | 0.022 | -0.027 | -0.130 |
| E-15 | -0.552 | -0.294 | 0.129 | -0.252 | 0.066 | -0.036 | -0.389 | -0.196 | -0.127 | 0.180 | -0.045 | 0.026 |
| E-16 | -0.511 | -0.246 | 0.079 | 0.008 | 0.197 | 0.033 | -0.118 | -0.175 | -0.137 | 0.247 | -0.026 | 0.212 |
| F-1 | -0.569 | 0.263 | -0.099 | -0.038 | -0.313 | -0.277 | -0.228 | 0.149 | 0.076 | 0.053 | -0.090 | 0.058 |
| F-2 | -0.601 | 0.304 | -0.139 | -0.044 | -0.271 | -0.218 | -0.268 | 0.046 | 0.084 | 0.162 | -0.038 | 0.010 |
| F-3 | -0.628 | 0.308 | -0.105 | -0.104 | -0.182 | -0.207 | -0.196 | 0.084 | 0.053 | 0.206 | -0.038 | 0.059 |
| F-4 | -0.459 | 0.062 | 0.075 | 0.096 | -0.367 | 0.070 | 0.065 | -0.173 | 0.077 | 0.337 | 0.326 | -0.174 |
| G-1 | -0.430 | 0.209 | 0.019 | -0.175 | 0.093 | -0.535 | -0.006 | -0.129 | 0.022 | -0.036 | 0.053 | 0.081 |
| G-2 | 0.074 | 0.009 | 0.113 | 0.019 | 0.389 | -0.407 | 0.127 | 0.105 | -0.240 | 0.106 | 0.323 | 0.113 |
| G-3 | -0.470 | 0.239 | 0.066 | -0.016 | 0.002 | -0.583 | 0.019 | 0.013 | 0.039 | -0.127 | -0.082 | 0.147 |
| G-4 | -0.552 | 0.213 | -0.056 | 0.120 | -0.167 | -0.314 | -0.076 | 0.137 | -0.030 | 0.052 | -0.153 | -0.045 |
| H-1 | 0.152 | 0.085 | 0.062 | -0.054 | 0.397 | 0.100 | -0.126 | 0.280 | -0.091 | 0.317 | -0.151 | 0.160 |
| H-2 | -0.035 | -0.191 | -0.100 | 0.247 | 0.100 | -0.168 | 0.329 | 0.091 | -0.084 | 0.367 | 0.063 | 0.106 |
| I-1 | -0.428 | 0.389 | -0.112 | -0.109 | -0.295 | -0.121 | 0.071 | -0.185 | 0.007 | -0.255 | -0.158 | 0.001 |
| I-2 | -0.488 | 0.271 | -0.058 | -0.176 | 0.218 | 0.121 | -0.135 | 0.137 | 0.099 | -0.150 | 0.089 | -0.210 |
| I-3 | -0.445 | 0.437 | 0.007 | -0.102 | -0.101 | 0.280 | -0.098 | -0.067 | -0.107 | -0.037 | 0.092 | -0.063 |
| I-4 | -0.493 | 0.457 | -0.006 | 0.015 | -0.191 | 0.069 | 0.113 | -0.181 | -0.190 | 0.143 | -0.051 | -0.221 |
| I-5 | -0.492 | 0.164 | 0.011 | 0.057 | -0.265 | 0.082 | 0.181 | -0.191 | 0.003 | 0.197 | 0.421 | 0.006 |
| I-6 | -0.484 | 0.209 | 0.099 | 0.016 | 0.129 | 0.222 | -0.126 | 0.155 | 0.135 | -0.231 | 0.276 | 0.165 |
| I-7 | -0.521 | 0.190 | 0.044 | 0.051 | 0.225 | 0.236 | 0.068 | 0.114 | 0.097 | -0.186 | 0.263 | 0.242 |
| I-8 | -0.666 | 0.344 | -0.072 | -0.022 | -0.008 | -0.004 | 0.109 | 0.051 | 0.042 | -0.094 | 0.038 | 0.166 |
| I-9 | -0.575 | 0.362 | -0.025 | 0.013 | -0.048 | -0.252 | 0.137 | 0.029 | 0.124 | -0.153 | -0.192 | 0.099 |
| I-10 | -0.512 | 0.307 | -0.003 | 0.026 | 0.105 | -0.157 | 0.128 | -0.219 | -0.023 | 0.045 | -0.251 | 0.041 |
| I-11 | -0.401 | 0.296 | 0.052 | -0.050 | 0.372 | 0.186 | 0.111 | 0.087 | -0.052 | -0.090 | 0.008 | -0.249 |
| I-12 | -0.443 | 0.397 | -0.090 | 0.004 | 0.300 | 0.083 | 0.021 | -0.054 | 0.091 | 0.051 | 0.069 | 0.166 |
| I-13 | -0.401 | 0.307 | -0.136 | 0.055 | 0.087 | 0.038 | -0.176 | -0.081 | 0.238 | -0.013 | 0.275 | 0.055 |
| I-14 | -0.512 | 0.340 | -0.088 | 0.020 | 0.104 | 0.206 | -0.145 | 0.135 | 0.175 | -0.139 | 0.035 | -0.044 |
| I-15 | -0.454 | 0.407 | -0.069 | -0.126 | 0.241 | 0.138 | 0.206 | 0.123 | -0.120 | -0.079 | -0.043 | -0.045 |
| I-16 | -0.464 | 0.412 | -0.136 | -0.070 | -0.136 | 0.178 | 0.211 | -0.148 | -0.283 | 0.080 | -0.167 | -0.179 |
| I-17 | -0.460 | 0.307 | -0.183 | 0.032 | 0.427 | 0.062 | 0.083 | 0.106 | -0.072 | 0.295 | -0.057 | -0.009 |
| I-18 | -0.469 | 0.334 | -0.105 | -0.063 | 0.331 | 0.204 | 0.132 | 0.028 | -0.160 | 0.102 | -0.040 | -0.009 |
| J1-1 | 0.321 | 0.278 | 0.384 | -0.412 | 0.024 | 0.102 | -0.173 | -0.002 | -0.132 | 0.132 | -0.094 | 0.143 |
| J1-2 | -0.014 | 0.249 | 0.262 | -0.317 | -0.126 | 0.193 | 0.233 | 0.271 | 0.061 | 0.185 | -0.129 | -0.168 |
| J1-3 | 0.276 | 0.221 | 0.410 | -0.392 | -0.125 | 0.101 | 0.044 | 0.121 | 0.024 | 0.159 | 0.059 | -0.044 |
| J1-4 | -0.294 | -0.074 | -0.420 | 0.340 | -0.042 | 0.114 | -0.094 | -0.006 | 0.245 | 0.160 | -0.007 | -0.270 |
| J1-5 | -0.294 | -0.070 | -0.261 | 0.262 | -0.062 | -0.088 | -0.200 | 0.185 | 0.317 | 0.146 | 0.183 | -0.209 |
| J1-6 | 0.150 | 0.186 | 0.537 | -0.136 | -0.123 | 0.059 | 0.091 | 0.076 | 0.280 | -0.144 | -0.052 | 0.059 |
| J1-7 | 0.297 | 0.214 | 0.397 | -0.195 | -0.250 | 0.111 | -0.007 | -0.096 | 0.179 | 0.207 | 0.100 | 0.114 |
| J1-8 | 0.298 | 0.179 | 0.517 | -0.297 | 0.000 | -0.067 | 0.131 | 0.176 | 0.192 | 0.057 | 0.068 | -0.064 |
| J1-9 | 0.282 | 0.218 | 0.557 | -0.169 | -0.143 | -0.108 | 0.090 | 0.080 | 0.177 | 0.116 | -0.051 | -0.049 |
| J1-A | -0.016 | 0.211 | 0.192 | -0.060 | -0.311 | 0.035 | 0.163 | -0.276 | -0.202 | -0.077 | 0.139 | -0.097 |
| J2-1 | -0.010 | -0.021 | 0.421 | 0.270 | -0.151 | -0.235 | 0.224 | 0.247 | -0.109 | -0.153 | 0.171 | -0.200 |
| J2-2 | -0.073 | 0.047 | 0.313 | 0.388 | -0.074 | 0.096 | -0.074 | 0.142 | -0.078 | 0.085 | -0.083 | -0.106 |
| J2-3 | -0.027 | 0.004 | 0.316 | 0.515 | 0.099 | 0.166 | -0.369 | -0.053 | 0.216 | -0.029 | -0.100 | -0.056 |
| J2-4 | -0.186 | 0.114 | 0.282 | 0.433 | 0.128 | 0.135 | -0.172 | -0.121 | 0.244 | 0.177 | -0.269 | -0.053 |
| J2-5 | -0.192 | 0.152 | 0.271 | 0.437 | -0.055 | 0.095 | 0.062 | -0.107 | -0.097 | -0.038 | -0.339 | 0.148 |
| J2-6 | -0.094 | 0.156 | 0.281 | 0.495 | -0.076 | 0.082 | 0.015 | 0.200 | -0.173 | -0.155 | -0.168 | -0.116 |
| J2-7 | -0.082 | 0.163 | 0.426 | 0.558 | -0.008 | -0.142 | -0.047 | 0.112 | -0.137 | -0.048 | 0.176 | 0.123 |
| J2-8 | -0.191 | 0.158 | 0.415 | 0.583 | 0.035 | -0.069 | 0.058 | 0.103 | -0.169 | 0.085 | 0.156 | 0.121 |
| J2-A | 0.258 | -0.034 | -0.036 | -0.207 | 0.124 | -0.118 | 0.071 | 0.443 | 0.169 | 0.212 | -0.154 | -0.003 |

It's interesting that the indicators of the relationship of the patient with the doctor or the pharmacist were not significantly associated with indicators of perseverance in applying the therapy; while good relationship with doctor and pharmacist does not always coincide, it is obvious that the positive reactions to these questions are scattered on two factors (3 and 4).

Some questions of the scale are almost completely independent of the others, for example, sub-question on a scale of health problems related to sexual desire is the only defined by factor 5.

Question G (related to anxiety, stress problems) is defined by factor 6, but is also related to the first factor and the same happened with the reaction to the first part of the question E (perseverance in applying the therapy) on factor 7.

Factor 8 is defined by the first four questions of the scale, which are related to perseverance in applying the therapy, but also to the verification of the positive impact of the drug on patients' health, satisfaction with how the patient is accepted by his environment, and to some extent the help of friends or family in the regular application of therapy (question D).

Factor 9 is almost solely defined by issues of perseverance (question E); those questions are obviously scattered on several factors, indicating that the perseverance in applying the therapy is a multidimensional phenomenon.

Factor 10 associates memory problems with alcohol abuse.

Memory problems occur also on the factor 11, but are followed by patients' belief that he is capable of solving their problems on his own.

Question C: ``How much do your family or friends help you remember to take medicine on time'' is practically only one with significant saturation on factor 12 (Table 4).

**Table 4.** Psychometric characteristics

| | Classical | Alternative |
|---|---|---|
| Cronbach α | 0.74 | 0.94 |
| Representativeness | 0.15 | 0.59 |
| Homogeneity | 0.48 | 0.32 |
| Discrimination | 0.37 | 0.40 |

Psychometric characteristics of alternatively processed data are significantly better than those obtained using conventional methods of processing, especially in terms of reliability and representativeness of the scale

## CONCLUSION

Alternative method of processing the individual results and psychometric properties determined by that process are presented on Culig′s questionnaire of perseverance. Those properties are better than those calculated by conventional way of processing. Also, the factor structure of indicators that make Culig′s scale is presented, with the obvious complexity of patients' reactions. Such a way of data processing opens the possibility of multivariate analysis of the results in the questionnaire, which is important for further researches.

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### *Contribution of individual authors:*

Aleksandar Momirovic - Study design, Writing the manuscript, Statistical analyses, Interpretation of data;
Mirela Ganza - Acquisition of data;
Borna Culig - Literature searches;
Marcel Leppee - Drafting the manuscript, Interpretation of data;
Ivana Prga - Acquisition of data.

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## **Appendix.** Adherence Scale Culig

*A. General information*

1. Age
   a) 26-35
   b) 36-45
   c) 46-55
   d) 55-65
   e) 65+
2. Gender
   a) male
   b) female
3. Employment
   a) employed
   b) unemployed
   c) retired
   d) beneficiary of social assistance
   e) student
   f) housewife
   g) farmer
   h) other
4. Education
   a) university degree
   b) bachelor degree
   c) high school
   d) primary school
   e) non of stated
5. Croatian veteran
   a) yes
   b) no
6. Do you live alone
   a) yes
   b) no
7. Marital status
   a) married
   b) divorced
   c) widower/widow
   d) extra-marital relationship
   e) never married
8. Disability
   a) yes
      if yes, what percentage?_____
   b) no

*B. These questions revealed the subject's attitude towards his ability to comply with the physician's instructions and whether he/she believe his/her therapy to be beneficial for his/her health*

| | Question | I am not sure at all | I am quite sure | I am very sure | I am absolutely sure |
|---|---|---|---|---|---|
| 1. | Are you sure you will be able to comply with your physician's medication instructions? | 0 | 1 | 2 | 3 |
| 2. | Are you sure that treatment will be positive for your health? | 0 | 1 | 2 | 3 |

*C. Community (family and friend) support in your health treatment*

| | Question | I am very unsatisfied | I am mostly unsatisfied | I am mostly satisfied | I am very satisfied |
|---|---|---|---|---|---|
| 1. | Are you satisfied with the support of your family and friends? | 0 | 1 | 2 | 3 |
| 2. | Do your family and friends remind you to take medication on time? | 0 | 1 | 2 | 3 |

*D. When was the last time when you failed to take your medication*

1. last week ☐
2. 1-2 week ago ☐
3. 3-4 week ago ☐
4. 1-3 month ago ☐
5. more than 3 months ago ☐
6. I never fail to take my medication on time ☐

*E. People do not take their medication for various reasons. Here is a list of reasons for not taking your medication/drug*

| | Cause of nonadherence | Never | Very rare (1-2 yearly) | Sometimes (3-5 yearly) | Often (more than 5 yearly) |
|---|---|---|---|---|---|
| 1. | I was not at home | 0 | 1 | 2 | 3 |
| 2. | The drug was not available due to the short supply | 0 | 1 | 2 | 3 |
| 3. | I just forgot | 0 | 1 | 2 | 3 |
| 4. | I take a number of drugs several times a day | 0 | 1 | 2 | 3 |
| 5. | I wanted to avoid side effects | 0 | 1 | 2 | 3 |
| 6. | I did not want other people to see me taking drug | 0 | 1 | 2 | 3 |
| 7. | My doctor frequently changes my therapy | 0 | 1 | 2 | 3 |
| 8. | I felt the drug to be toxic/harmful | 0 | 1 | 2 | 3 |
| 9. | I felt sleepy at medication time | 0 | 1 | 2 | 3 |
| 10. | I had cold | 0 | 1 | 2 | 3 |
| 11. | I felt depressed or broken | 0 | 1 | 2 | 3 |
| 12. | I had problems with taking medicine at specific time (eg. with meal, on an ampty stomach) | 0 | 1 | 2 | 3 |
| 13. | I have ran out of medication | 0 | 1 | 2 | 3 |
| 14. | I felt well | 0 | 1 | 2 | 3 |
| 15. | I was afraid of developing drug dependence | 0 | 1 | 2 | 3 |
| 16. | The drug was too expensive | 0 | 1 | 2 | 3 |

*F. How often during the last week you*

| | Question | Never | Rarely | Sometimes | Often |
|---|---|---|---|---|---|
| 1. | Felt sad | 0 | 1 | 2 | 3 |
| 2. | Felt lonely | 0 | 1 | 2 | 3 |
| 3. | Were down in the mouth | 0 | 1 | 2 | 3 |
| 4. | Had difficulty with memory | 0 | 1 | 2 | 3 |

*G. How often during the last month you*

| | Question | Never | Rarely | Sometimes | Often |
|---|---|---|---|---|---|
| 1. | Were upset because something unexpected happened | 0 | 1 | 2 | 3 |
| 2. | You were confident that you can solve your problem | 0 | 1 | 2 | 3 |
| 3. | You were nervous or stressed | 0 | 1 | 2 | 3 |
| 4. | You had a feeling that problems accumulated and you can not solve them | 0 | 1 | 2 | 3 |

*H. Health habits*

1. How often do you exercise actively (cycling, brisk walking, jogging, etc.)?
   - Never
   - Less than once a week
   - 1-2 times a week
   - 3-4 times a week
   - 5 or more times a week

2. How often do you drink alcohol?
   - Every day
   - Almost every day
   - 3-4 times a week
   - 1-2 times a week
   - 2-3 times a month
   - Once a month
   - Never

*I. Did you have health problems during the month?*

| | Health problem | I did not have this health problem | I had this health problem: It does not matter | Bothers me a little | Bothers me a quite | Bothers me very much |
|---|---|---|---|---|---|---|
| 1. | Fatigue | 0 | 1 | 2 | 3 | 4 |
| 2. | Fever or cold | 0 | 1 | 2 | 3 | 4 |
| 3. | Vertigo | 0 | 1 | 2 | 3 | 4 |
| 4. | Pain or stiffness | 0 | 1 | 2 | 3 | 4 |
| 5. | Problem with memory | 0 | 1 | 2 | 3 | 4 |
| 6. | Nausea or vomiting | 0 | 1 | 2 | 3 | 4 |
| 7. | Diarrhea | 0 | 1 | 2 | 3 | 4 |
| 8. | Depression | 0 | 1 | 2 | 3 | 4 |
| 9. | Nervousness, anxiety | 0 | 1 | 2 | 3 | 4 |

*I. (continous) Did you have health problems during the month?*

| | Health problem | I did not have this health problem | I had this health problem | | | |
|---|---|---|---|---|---|---|
| | | | It does not matter | Bothers me a little | Bothers me a quite | Bothers me very much |
| 10. | Insomnia sleepiness | 0 | 1 | 2 | 3 | 4 |
| 11. | Skin changes | 0 | 1 | 2 | 3 | 4 |
| 12. | Cough | 0 | 1 | 2 | 3 | 4 |
| 13. | Headache | 0 | 1 | 2 | 3 | 4 |
| 14. | Loss of appetite | 0 | 1 | 2 | 3 | 4 |
| 15. | Abdominal bloating | 0 | 1 | 2 | 3 | 4 |
| 16. | Pain in muscles and joints | 0 | 1 | 2 | 3 | 4 |
| 17. | Sexual problems | 0 | 1 | 2 | 3 | 4 |
| 18. | Weight changes | 0 | 1 | 2 | 3 | 4 |

*J. - 1. Claims about relationship with your family physician*

| | Relationship with family practice | Yes | No |
|---|---|---|---|
| 1. | I can contact my doctor whenever I have personal or emotional problem | 0 | 1 |
| 2. | I go to the doctor for preventive examinations | 0 | 1 |
| 3. | My doctor knows if I live healthy (nutrition, smoking, alcochol) | 0 | 1 |
| 4. | Sometimes my doctor does not listen me | 0 | 1 |
| 5. | I do not always feel comfortable asking my doctor questions | 0 | 1 |
| 6. | My doctor monitors my problem solving (either directly or by telephone) | 0 | 1 |
| 7. | My doctor knows how much my family affects my health | 0 | 1 |
| 8. | The doctor always explains me the results of laboratory tests, X-rays and other specialist findings | 0 | 1 |
| 9. | I notice that my doctor advises and collaborates well with other healthcare professionals (eg pharmacists, nurses, etc.) | 0 | 1 |

*J. - 1A. How long are you visiting your family physician?*

1. Less than 6 months
2. 6-12 months
3. 1-2 years
4. 4-5 years
5. More than 5 years

*J. - 2. Pharmacist's questions and advice offered to the patient*

| | Questions and advices | Always | Sometime | Never |
|---|---|---|---|---|
| 1. | Has the pharmacist asked you whether you took the drug for the first time | 0 | 1 | 2 |
| 2. | Has the pharmacist asked you to repeat aloud the instructions on how to take the drug | 0 | 1 | 2 |
| 3. | Has the pharmacist informed you on the importance of complying to the therapy prescribed | 0 | 1 | 2 |
| 4. | Has the pharmacist advised you in detail on how to take the drug | 0 | 1 | 2 |
| 5. | Has the pharmacist advised you on combining your therapy with OTC drugs | 0 | 1 | 2 |
| 6. | Has the pharmacist advised you on solving the possible drug side effects | 0 | 1 | 2 |
| 7. | Has the pharmacist asked you about skipping your therapy doses and why | 0 | 1 | 2 |
| 8. | Has the pharmacist asked you about your attitude towards your drug therapy | 0 | 1 | 2 |

*J. - 2A. How often are you visiting your pharmacist?*

1. Once in a week or more often
2. Once in a month or more often
3. Several visits in a year

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