

# Minho Communication Assessment Scale: Development and Validation



## Minho Communication Assessment Scale: Desenvolvimento e Validação

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### ABSTRACT

**Introduction:** Verbal and non-verbal communication skills are core competencies in medical practice and should be acquired and monitored in medical schools. However, their assessment poses a challenge. The aim of this study is to develop and assess the psychometric properties, validity and reliability of a communication assessment scale.

**Material and Methods:** We developed a communication assessment scale, composed by five dimensions (Structure, Way of Questioning, Behavior and Posture, Clarity of information and Emotional dimension). Two focus groups and a development group, composed by faculty members and standardized patients experienced in assessment, were responsible for creating the scale.

**Results:** The communication assessment scale was tested on 332 students from the 3<sup>rd</sup> and 6<sup>th</sup> year of medical school, with a total of 2754 assessments, performed by faculty members and standardized patients. A descriptive analysis, an exploratory factor analysis, a confirmatory factor analysis and a Cronbach's alpha analysis to establish internal reliability were conducted.

**Discussion:** The Minho Communication Assessment Scale can be effectively used by both faculty members and standardized patients, providing correct students assessment and relevant feedback to the students. The final Minho Communication Assessment Scale has a total of 19 items, being simple and intuitive to use. The exploratory factor analysis and confirmatory factor analysis results were satisfactory. Cronbach's alpha value revealed high internal consistency of Minho Communication Assessment Scale.

**Conclusion:** The final Minho Communication Assessment Scale proved to be simple to use and to have very good psychometric properties. Our results show that the Minho Communication Assessment Scale is a valid scale to assess communication skills which can be accurately replicated on objective structured clinical examinations focusing on communication.

**Keywords:** Communication; Physician-Patient Relations; Portugal; Reproducibility of Results; Students, Medical; Surveys and Questionnaires

### RESUMO

**Introdução:** A comunicação verbal e não-verbal são competências essenciais na prática médica e devem ser adquiridas e monitorizadas nas escolas médicas. Contudo, a sua avaliação representa um desafio. O objetivo deste trabalho consistiu em desenvolver e avaliar as propriedades psicométricas, validade e fiabilidade de uma escala de avaliação de comunicação.

**Material e Métodos:** Desenvolvemos uma escala de avaliação de comunicação, composta por cinco dimensões (Estrutura, Modo de Questionar, Comportamento e Postura, Clareza de Informação e a dimensão Emocional). Dois *focus groups* e um grupo de desenvolvimento, composto por membros do corpo docente e pacientes estandardizados experientes em avaliação, foram responsáveis por criar a escala.

**Resultados:** A escala de avaliação de comunicação foi testada em 332 alunos de medicina do terceiro e sexto ano curricular, num total de 2754 avaliações, realizada por docentes e pacientes estandardizados. Realizámos uma análise descritiva, uma análise fatorial exploratória, uma análise fatorial confirmatória e uma análise de alfa de Cronbach, de modo a estabelecer a fiabilidade interna da escala.

**Discussão:** A *Minho Communication Assessment Scale* pode ser usada eficazmente por docentes e pacientes estandardizados, fornecendo uma avaliação correta e um *feedback* relevante aos estudantes. A *Minho Communication Assessment Scale* final tem um total de 19 itens, sendo simples e intuitiva de usar. Os resultados da análise fatorial exploratória e confirmatória foram satisfatórios. O valor de alfa de Cronbach's revelou valores elevados de consistência interna.

**Conclusão:** A versão final da *Minho Communication Assessment Scale*, demonstrou ser simples de usar e possuir muito boas propriedades psicométricas. Os resultados demonstram que a *Minho Communication Assessment Scale* é uma escala válida para avaliar as capacidades de comunicação e pode ser replicada em *objective structured clinical examinations* que se foquem nessa avaliação.

**Palavras-chave:** Comunicação; Estudantes de Medicina; Inquéritos e Questionários; Portugal; Relações Médico-Doente; Reprodutibilidade dos Testes

### INTRODUCTION

Communication skills have been recognized in the literature as a core dimension in medical practice.<sup>1</sup> The Accreditation Council for Graduate Medical Education (ACGME)

and the American Board of Medical, Specialties (ABMS) jointly identified interpersonal and communication skills as one of the six general competencies for physicians.<sup>2-4</sup>

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The physician communication competence seems to positively influence a set of medical acts (e.g., clinical history collection, diagnosis formulation), promote the establishment of an adequate patient–physician relationship<sup>1</sup> and trigger a major positive influence on individual health outcomes, such as improvements in symptom relief, clinical outcomes, patient behavior<sup>5,6</sup> and therapeutic adherence.<sup>7</sup> For all these reasons, physician interpersonal and communication skills must be carefully considered in medical education and training.<sup>8,9</sup> Moreover, competency-based education has highlighted the need to explicitly and effectively provide training and quality assessment on communication skills during medical education. However, and despite all the above, serious communication problems are repeatedly experienced by patients and other health-care professionals.<sup>10</sup>

In order to develop successful training and assessment opportunities, validated measurement instruments must be available. A set of tools has been developed to assess these skills with different assessment approaches (e.g., video-taped or real time interactions) and sources (e.g., standardized patients or observers).<sup>8</sup> There are several instruments based on rating scales such as the Communication Assessment Tool<sup>4</sup> and the SEGUE framework.<sup>11</sup> The latter appears to be more appropriate to assess these behaviors and competencies. In fact, there is evidence that rating scales (i.e., more subjective measures) tend to show better reliability than checklists.<sup>12</sup> However, we must also reinforce that the subjectivity involved in the competence assessment through rating scales calls for specific training of the observers.<sup>8</sup>

While it is true that there has been a significant investment during the last twenty years in the development of scales focused on the doctor-patient relationship,<sup>13–15</sup> it is also true that the evidence of validity has not been systematically explored. In fact, evidence of convergent validity has been reported in the literature,<sup>8</sup> but less investment has been made considering distinct types of validity derived from the same tool. Providing validity and reliability evidence is a relevant issue in the evaluation of communication skills in the medical education context, as there is a need for further psychometric evaluations on communication skills measurements in order to ensure accurate assessment of medical students' performance during their training.<sup>16</sup>

Additionally, the literature postulates that non-verbal behavior is a very important component in the patient-doctor relationship, and that more scales based on non-verbal behaviors are needed.<sup>8</sup> These behaviors can significantly influence patient satisfaction with clinical practice<sup>17</sup> with some evidence suggesting that patients may be more attentive to non-verbal rather than traditional verbal behavior.<sup>18</sup>

Due to the absence of a Communication Assessment Scale (CAS) adapted to our assessment goals and to the Portuguese medical education reality, with this study, we aim to create and validate a new CAS, encompassing both verbal and non-verbal components, to assess communication skills to be used both by faculty and standardized pa-

tients (SPs). This allows the evaluation of communication skills in different settings.

## MATERIAL AND METHODS

This study was performed at the School of Medicine of the University of Minho, Braga, Portugal. The experimental protocol was approved by the Ethics Committee of the University of Minho.

An extensive literature review regarding health communication assessment scales, as well as their design, validation process and evaluation impact, was conducted through available databases.

Two focus groups (FG) were created, both with experienced faculty and SPs. In order to initiate the creation of the CAS, each FG independently defined the main categories that should be assessed in a medical communication exam, proposing a draft of the future communication assessment items. Afterwards, a development group (DG) was created (which included one senior and two junior faculty physicians, one psychologist and one statistician/psychometrician) that was responsible for rephrasing, categorizing and presenting a new draft to the two FG for validation of the prototype version. A prototype version of the CAS had 23 items. In a third moment, the two FG defined the relative weight attributed to each category and its elements.

The final CAS prototype was then applied on Objective Structured Clinical Examination (OSCE) stations in which the student had to collect a patient medical history, conduct a physical examination and deliver bad news to trained SPs.<sup>19</sup> In all these moments, student's performance was assessed with the CAS by both faculty and SPs. Training on the use of the scale was provided to both faculty and SPs, thus ensuring less inter-examiner variability. A total of 2754 assessments were conducted.

The Declaration of Helsinki<sup>20</sup> and the Council of Europe's Convention on Human Rights<sup>21</sup> were strictly followed.

Regarding sample size, we used the 10-times rule method,<sup>22,23</sup> accomplishing the minimum sample size of 230 assessments.

To test the normality assumption, we used the following rules-of-thumb: absolute skewness (Sk) and kurtosis (K) values lower than 3.0 and 8.0, respectively, indicate normal distribution. Items with Sk and K over the limit were eliminated.<sup>24</sup>

In order to assess the validity and reliability of the CAS, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and internal reliability Cronbach's alpha scores were performed.

EFA is a statistical analysis used to explore the underlying structure and relationship of multiple variables. EFA allows to reduce the number of variables and to evaluate the construct validity of a scale.<sup>25</sup> In order to assess if the CAS is suitable for factor analysis, we used: 1) Kaiser-Meyer-Olkin (KMO), which measures sampling adequacy, ranging from 0 to 1, in which higher values mean higher suitability, 2) Bartlett's test of sphericity, which tests the hypothesis that the correlation matrix is an identity matrix, which would indicate

that the variables are unrelated and therefore unsuitable for structure detection and 3) Oblimin rotation method. Values of KMO above 0.8 are considered meritorious.<sup>26</sup>

CFA models the relationship between indicators and underlying latent variables, and through this, it is used to confirm or reject the measurement theory, verifying if the CAS accurately assesses communication. Goodness-of-fit (GFI), comparative fit index (CFI) and root mean square error of approximation (RMSEA) were also used to examine the GFI of the model. Regarding CFI, values over 0.9 represent an acceptable model fit.<sup>27</sup> While for RMSEA, values below 0.05 are classified as a good fit<sup>22</sup> and in between 0.05 and 0.08 are classified as an acceptable fit.<sup>28,29</sup> GFI, CFI and RMSEA were evaluated using the  $\chi^2$  statistics.

The internal consistency was tested using the Cronbach alpha score. If  $\alpha \geq 0.9$ , the internal consistency is considered to be excellent, and if  $0.7 \leq \alpha < 0.9$ , it is considered to

be good.<sup>30</sup>

Data was analyzed using IBM SPSS Statistics and IBM SPSS Amos (v. 24.0).

## RESULTS

The final CAS prototype, was composed by 23 items, divided into five dimensions (Structure, Way of Questioning, Behavior and Posture, Clarity of information and Emotional dimension), scored with a Likert scale ranging from 1 (totally disagree) to 5 (totally agree) [Table 1 for the English version and Appendix 1 for the Portuguese version (see Appendix 1: [https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/12727/Appendix\\_01.pdf](https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/12727/Appendix_01.pdf))]. Higher scores indicate more effective health communication behavior.

The CAS was tested on 332 students, 69% (n = 229) were 3<sup>rd</sup> year students and 31% (n = 103) were 6<sup>th</sup> year

Table 1 – Communication assessment scale (CAS) in English language

| Item | Question  | Dimension |
|------|---|-----------|
| 1    | Started the interview correctly and presented himself / herself                   | S         |
| 2    | Presented an appropriate clothing   | BP        |
| 3    | Used the open-ended questions properly  | WQ        |
| 4    | Allowed time for the patient to answer  | BP        |
| 5    | Used appropriate strategies to clarify the information provided by the patient    | WQ        |
| 6    | Acted within his/her competencies   | BP        |
| 7    | Explored and managed the patient's emotions properly                              | ED        |
| 8    | Created an empathic relationship with the patient                                 | ED        |
| 9    | Explored patient's beliefs and responded to their concerns                        | ED        |
| 10   | Demonstrated a correct body posture   | BP        |
| 11   | Kept appropriate eye contact  | BP        |
| 12   | Used clear language avoiding technical terms                                      | WQ        |
| 13   | Demonstrated respect for the patient  | BP        |
| 14   | Avoided judgments   | BP        |
| 15   | Built correctly the questions   | WQ        |
| 16   | Used an appropriate tone, volume and speed of speech                              | WQ        |
| 17   | Used appropriate strategies to verify that the patient understood the information | WQ        |
| 18   | Maintained a proper emotional response throughout the interview                   | ED        |
| 19   | Managed the interview time correctly  | S         |
| 20   | Summarized the patients' symptoms properly  | S         |
| 21   | Organized the clinical interview chronologically                                  | S         |
| 22   | Organized the interview in a logical and flexible way                             | S         |
| 23   | Properly concluded the interview  | S         |

S: structure; WQ: way of questioning; BP: behavior and posture; CI: clarity of information; ED: emotional dimension.

Portuguese version is in Appendix 1 (see Appendix 1: [https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/12727/Appendix\\_01.pdf](https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/12727/Appendix_01.pdf)).

Table 2 – Descriptive statistics regarding the number of assessments, the number of students, number of faculty members and number of SPs members

|                          | 3 <sup>rd</sup> year students<br>(n = 229) | 6 <sup>th</sup> year students<br>(n = 103) | Total<br>assessments |
|--------------------------|--|--|----------------------|
| Faculty members (n = 25) | 969 (35.3%)                                | 484 (17.6%)                                | 1453                 |
| SPs members (n = 23)     | 784 (28.6%)                                | 508 (18.5%)                                | 1292                 |
| <b>Total assessments</b> | <b>1753</b>                                | <b>992</b>                                 | <b>2745</b>          |

students, each in six types of different situations of the clinical history collection simulation. The number of assessments for each student varied from 1 to 15. The median assessment number was 10 with an interquartile range of 9. Students' assessments were divided into 3<sup>rd</sup> year [1753 (63.9%)] and 6<sup>th</sup> year students [992 (36.1%)] assessments. The evaluations were made by Faculty [1453 (52.9%)] and SPs [1292 (47.1%)] in OSCE stations. There were 25 faculty members and 23 SPs involved in the evaluation process (Table 2).

A descriptive analysis of the five dimensions can be

found at Table 3.

Regarding normality of the results, most items show a slight leptokurtic tendency and a bias for higher scores (negative skewness). The items with absolute skewness scores above 3 and kurtosis higher than 8 show a deviation from the normal distribution<sup>24</sup>; for that reason, items two and 14 were excluded from the CAS.

To validate the construction of the Minho-CAS and to identify the underlying relationship between the items, we performed an EFA using the principal axis factoring (PAF) and the Oblimin rotation method. On Table 4 we present the

Table 3 – Descriptive analysis of the five dimensions

| Dimension                         | Min. | Max. | M    | SD   |
|-----------------------------------|------|------|------|------|
| <b>S: Structure</b>               | 1.0  | 5.0  | 3.94 | 0.89 |
| <b>WQ: Way of questioning</b>     | 1.0  | 5.0  | 4.17 | 0.69 |
| <b>BP: Behavior and posture</b>   | 1.0  | 5.0  | 4.36 | 0.63 |
| <b>CI: Clarity of information</b> | 1.0  | 5.0  | 3.93 | 0.89 |
| <b>ED: Emotional dimension</b>    | 1.0  | 5.0  | 3.78 | 0.87 |

Min: minimum score; Max: maximum score; M: mean; SD: standard deviation

Table 4 – Exploratory factor analysis (EFA)

| Nº | Items  | Dim | Min | Max | Me   | M    | SD   | Sk    | Sk/SESk | Ku    | Ku/SEKu |
|----|--|-----|-----|-----|------|------|------|-------|---------|-------|---------|
| 1  | Started correctly the interview and presented himself / herself                              | S   | 2   | 5   | 5.00 | 4.64 | 0.64 | -1.87 | -9.88   | 3.25  | 8.65    |
| 2  | Presented an appropriate clothing  | BP  | 4   | 5   | 5.00 | 4.93 | 0.26 | -3.32 | -17.57  | 9.14  | 24.32   |
| 3  | Used properly the open-ended questions   | WQ  | 1   | 5   | 5.00 | 4.10 | 1.08 | -0.89 | -4.73   | -0.23 | -0.62   |
| 4  | Complied with the response time of the patient   | BP  | 1   | 5   | 5.00 | 4.30 | 1.03 | -1.44 | -7.64   | 1.33  | 3.54    |
| 5  | Used appropriate strategies to clarify the information provided by the patient               | WQ  | 1   | 5   | 4.00 | 3.77 | 1.04 | -0.45 | -2.37   | -0.42 | -1.13   |
| 6  | Acted within his/her competencies  | BP  | 2   | 5   | 5.00 | 4.66 | 0.63 | -2.11 | -11.18  | 4.88  | 12.98   |
| 7  | Explored and managed properly the patient's emotions   | ED  | 1   | 5   | 4.00 | 3.52 | 1.29 | -0.41 | -2.18   | -1.04 | -2.75   |
| 8  | Created an empathic relationship with the patient  | ED  | 1   | 5   | 4.00 | 3.83 | 1.06 | -0.58 | -3.07   | -0.51 | -1.36   |
| 9  | Explored beliefs and responded to the patient's concerns                                     | ED  | 1   | 5   | 3.00 | 3.26 | 1.33 | -0.19 | -1.02   | -1.17 | -3.11   |
| 10 | Demonstrated a correct body posture  | BP  | 2   | 5   | 5.00 | 4.61 | 0.75 | -1.82 | -9.63   | 2.27  | 6.04    |
| 11 | Kept appropriate eye contact   | BP  | 2   | 5   | 5.00 | 4.62 | 0.70 | -1.79 | -9.49   | 2.32  | 6.16    |
| 12 | Used light and handy speech avoiding technical terms   | WQ  | 1   | 5   | 5.00 | 4.45 | 0.88 | -1.83 | -9.68   | 3.18  | 8.47    |
| 13 | Demonstrated respect for the patient   | BP  | 2   | 5   | 5.00 | 4.76 | 0.55 | -2.44 | -12.89  | 5.86  | 15.60   |
| 14 | Avoided judgments  | BP  | 1   | 5   | 5.00 | 4.72 | 0.64 | -2.60 | -13.75  | 7.81  | 20.79   |
| 15 | Correctly built the questions  | WQ  | 1   | 5   | 5.00 | 4.33 | 0.92 | -1.37 | -7.23   | 1.23  | 3.27    |
| 16 | Used volume, speed and appropriate tone of voice   | WQ  | 1   | 5   | 5.00 | 4.26 | 0.96 | -1.25 | -6.62   | 0.94  | 2.49    |
| 17 | Used appropriate strategies to verify that the patient understood the issues and information | WQ  | 1   | 5   | 4.00 | 3.51 | 1.26 | -0.48 | -2.55   | -0.69 | -1.83   |
| 18 | Maintained a proper emotional response throughout the interview                              | ED  | 2   | 5   | 4.00 | 4.18 | 0.95 | -0.75 | -3.96   | -0.67 | -1.79   |
| 19 | Conducted a good interview time management   | S   | 1   | 5   | 4.00 | 3.91 | 1.13 | -0.68 | -3.58   | -0.74 | -1.98   |
| 20 | Summarized properly the patient information  | S   | 1   | 5   | 4.00 | 3.88 | 1.19 | -0.94 | -4.97   | 0.07  | 0.18    |
| 21 | Organized chronologically the clinical interview   | S   | 1   | 5   | 4.00 | 3.97 | 1.17 | -0.86 | -4.57   | -0.38 | -1.00   |
| 22 | Organized the interview in a logical and flexible way  | S   | 1   | 5   | 4.00 | 4.08 | 1.10 | -1.03 | -5.45   | 0.11  | 0.29    |
| 23 | Properly concluded the interview   | S   | 1   | 5   | 4.00 | 3.79 | 1.21 | -0.74 | -3.94   | -0.47 | -1.24   |

Dim: dimension; Min: minimum score; Max: maximum score; Me: median; M: means; SD: standard deviations; Sk: skewness; Ku: Kurtosis; Critical ratios (Sk / SE Sk; Ku / SE Ku)

Table 5 – Confirmatory factor analysis (CFA)

| Nº | Items  | Dim    | Min | Max | Me | M    | SD   | SK    | SK/SESK | Ku    | Ku/SEKu |
|----|--|--------|-----|-----|----|------|------|-------|---------|-------|---------|
| 1  | Started correctly the interview and presented himself / herself                              | I1_ED  | 1   | 5   | 5  | 4.68 | 0.64 | -2.36 | -50.5   | 6.54  | 70.0    |
| 2  | Presented an appropriate clothing  | I2     | 1   | 5   | 5  | 4.83 | 0.47 | -3.40 | -72.8   | 15.32 | 164.0   |
| 3  | Used properly the open-ended questions   | I3_WQ  | 1   | 5   | 4  | 4.16 | 0.90 | -0.92 | -19.6   | 0.45  | 4.8     |
| 4  | Complied with the response time of the patient   | I4_BP  | 1   | 5   | 5  | 4.37 | 0.79 | -1.28 | -27.4   | 1.68  | 17.9    |
| 5  | Used appropriate strategies to clarify the information provided by the patient               | I5_CI  | 1   | 5   | 4  | 3.97 | 0.95 | -0.80 | -17.2   | 0.36  | 3.9     |
| 6  | Acted within his/her competencies  | I6_BP  | 1   | 5   | 5  | 4.45 | 0.79 | -1.60 | -34.3   | 2.79  | 29.9    |
| 7  | Explored and managed properly the patient's emotions   | I7_ED  | 1   | 5   | 4  | 3.65 | 1.08 | -0.49 | -10.4   | -0.42 | -4.5    |
| 8  | Created an empathic relationship with the patient  | I8_ED  | 1   | 5   | 4  | 4.00 | 0.97 | -0.80 | -17.1   | 0.18  | 1.9     |
| 9  | Explored beliefs and responded to the patient's concerns                                     | I9_ED  | 1   | 5   | 4  | 3.58 | 1.15 | -0.51 | -10.9   | -0.53 | -5.7    |
| 10 | Demonstrated a correct body posture  | I10_BP | 1   | 5   | 5  | 4.46 | 0.79 | -1.61 | -34.4   | 2.77  | 29.6    |
| 11 | Kept appropriate eye contact   | I11_BP | 1   | 5   | 5  | 4.38 | 0.84 | -1.42 | -30.3   | 1.89  | 20.2    |
| 12 | Used light and handy speech avoiding technical terms   | I12_WQ | 1   | 5   | 4  | 4.29 | 0.84 | -1.12 | -24.1   | 1.09  | 11.7    |
| 13 | Demonstrated respect for the patient   | I13_BP | 1   | 5   | 5  | 4.66 | 0.63 | -2.12 | -45.4   | 5.46  | 58.5    |
| 14 | Avoided judgments  | I14    | 1   | 5   | 5  | 4.60 | 0.70 | -1.98 | -42.3   | 4.34  | 46.4    |
| 15 | Correctly built the questions  | I15_WQ | 1   | 5   | 4  | 4.22 | 0.84 | -0.96 | -20.6   | 0.73  | 7.8     |
| 16 | Used volume, speed and appropriate tone of voice   | I16_BP | 1   | 5   | 5  | 4.30 | 0.85 | -1.14 | -24.4   | 0.92  | 9.9     |
| 17 | Used appropriate strategies to verify that the patient understood the issues and information | I17_CI | 1   | 5   | 4  | 3.88 | 1.00 | -0.82 | -17.6   | 0.40  | 4.3     |
| 18 | Maintained a proper emotional response throughout the interview                              | I18_BP | 1   | 5   | 4  | 4.17 | 0.88 | -1.03 | -21.9   | 0.93  | 10.0    |
| 19 | Conducted a good interview time management   | I19_S  | 1   | 5   | 4  | 4.02 | 1.02 | -0.94 | -20.0   | 0.29  | 3.2     |
| 20 | Summarized properly the patient information  | I20_S  | 1   | 5   | 4  | 4.00 | 1.04 | -1.01 | -21.5   | 0.54  | 5.8     |
| 21 | Organized chronologically the clinical interview   | I21_S  | 1   | 5   | 4  | 3.81 | 1.07 | -0.69 | -14.8   | -0.18 | -1.9    |
| 22 | Organized the interview in a logical and flexible way  | I22_WQ | 1   | 5   | 4  | 4.04 | 0.92 | -0.80 | -17.1   | 0.21  | 2.3     |
| 23 | Properly concluded the interview   | I23_ED | 1   | 5   | 4  | 3.90 | 1.13 | -0.91 | -19.6   | 0.08  | 0.9     |

Dim: dimension; Min: minimum score; Max: maximum score; Me: median; M: means; SD: standard deviations; Sk: skewness; Ku: Kurtosis; Critical ratios (Sk / SE Sk; Ku / SE Ku)



descriptive analysis performed on each item, within each dimension, as well as the skewness, kurtosis and critical ratio scores of the EFA.

EFA results were satisfactory (KMO = 0.870; Bartlett's sphericity test  $\chi^2(210) = 1561$ ;  $p < 0.001$ ). As the Bartlett's sphericity test has a significance level of  $p < 0.001$ , we can assume homogeneity of variants.<sup>31</sup> With these results, we proceeded to the CFA analysis.

Repeating the normality verification method on the CFA, previously used with the EFA, items one and 13 were excluded, due to the skewness and kurtosis scores (Table 5).

Within the CFA, we conducted two models: model A and model B. Model A | 1<sup>st</sup> order CFA: to improve the CFA final model, the error terms e10 - e11, e7 - e9 and e8 - e23 were correlated. This model had a chi-square value,  $\chi^2(139) = 2269$ ;  $p < 0.001$  and a fit index of CFI = 0.927, RMSEA (HI90) = 0.075 (0.077). Model B | 2<sup>nd</sup> order CFA: since the model revealed a highly positive correlation between the considered latent dimensions, a second order latent dimension test (Minho-CAS) was performed. The model presents a chi-square value,  $\chi^2(144) = 2582$ ;  $p < 0.001$  and a CFI = 0.916, RMSEA (HI90) = 0.079 (0.081) (Figs. 1 and 2).

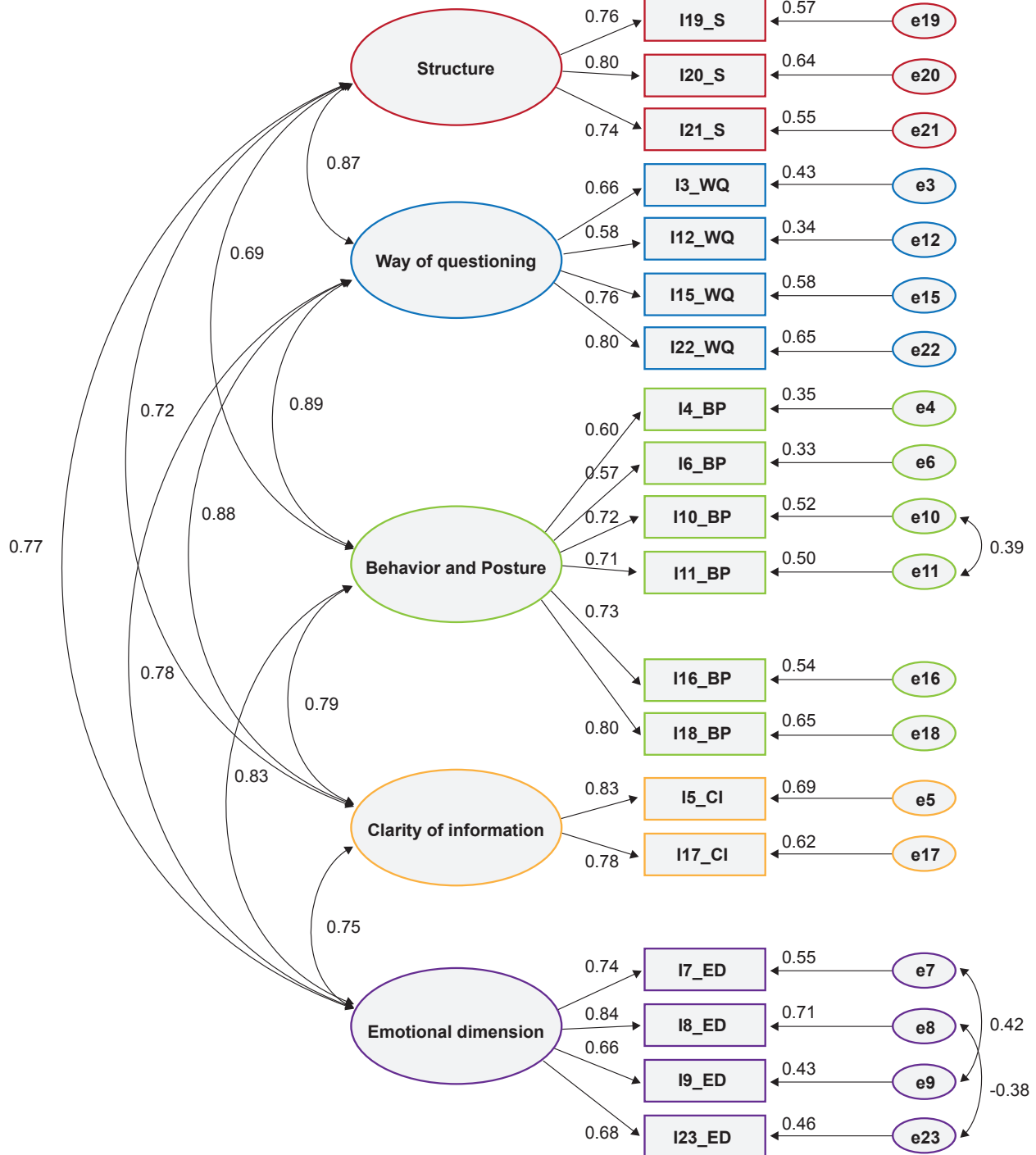


Figure 1 – Model A

The internal consistency of the dimensions was measured with Cronbach's alpha which can be seen in Table 6. For the final Minho-CAS [Appendix 2 (see Appendix 2:

[https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/12727/Appendix\\_02.pdf](https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/12727/Appendix_02.pdf)], composed by 19 items, the Cronbach's Alpha was 0.936.

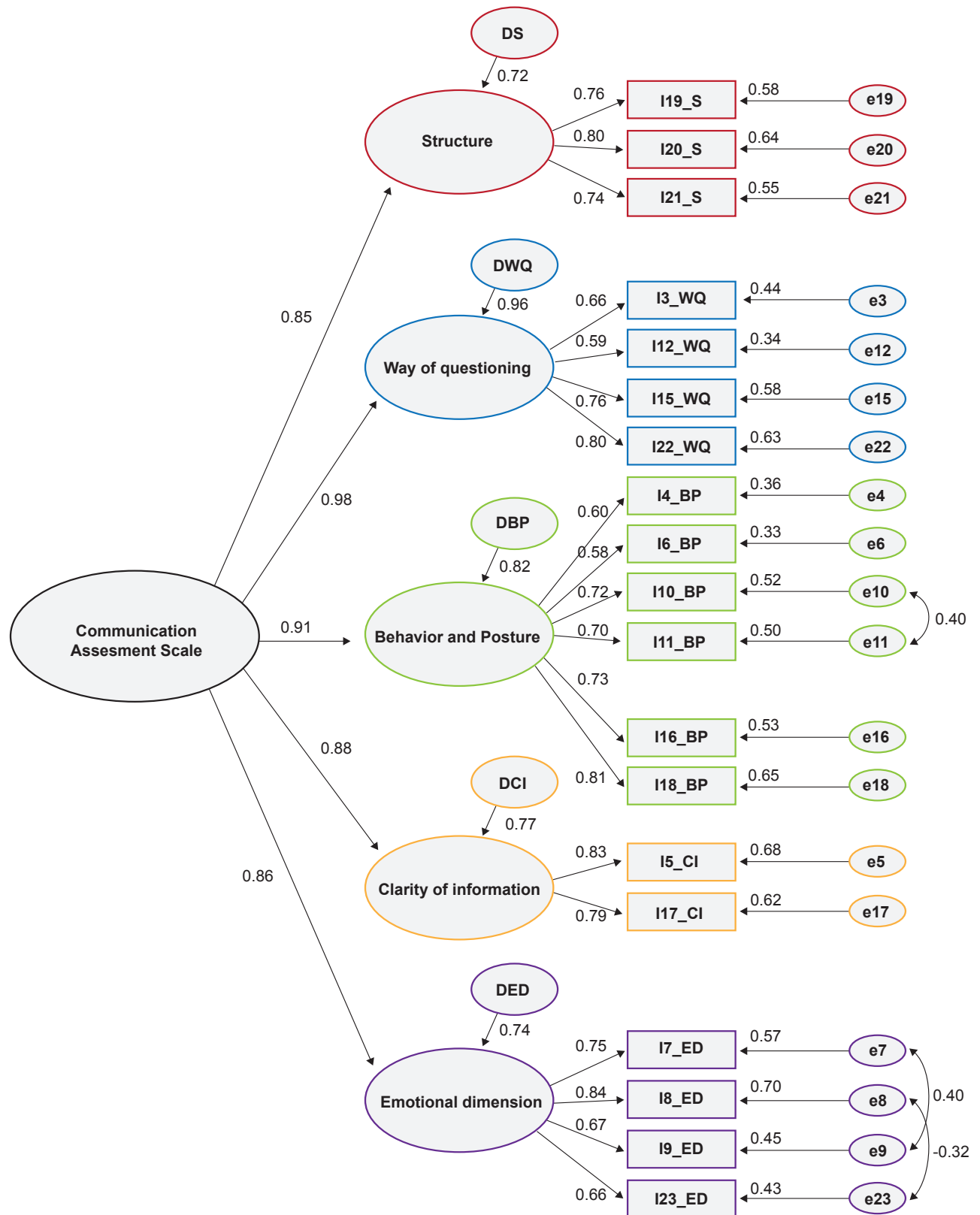


Figure 2 – Model B

**Table 6** – Internal consistency measured with Cronbach's alpha

| Dimension                            | Cronbach's alpha |
|--------------------------------------|------------------|
| Structure                            | 0.808            |
| Way of Questioning                   | 0.795            |
| Behavior and Posture                 | 0.851            |
| Clarity of Information               | 0.788            |
| Emotional Dimension                  | 0.819            |
| Minho Communication Assessment Scale | 0.936            |

## DISCUSSION

The Minho-CAS was designed as a tool to assess the communication (both verbal and non-verbal behaviors) skills of medical students during clinical scenarios. With this tool, we can perform a better assessment of these skills as well as provide good quality and relevant feedback to the students. Of notice, the Minho-CAS can be effectively used by both faculty members and SPs, providing two different perspectives of the communication process. This assessment tool presents relevant advantages: i) it is simple and intuitive, which enables a fast introduction of the process to new assessors; ii) it is fast to use, which allows assessors to fully complete the Minho-CAS while the student is still in the simulation scenario.

After starting with 23 items, the Minho-CAS was reduced to 19 items, to ensure a normal distribution of scores, using kurtosis and skewness cutoff values. This elimination was appropriate given our large sample size (2745 assessments) and necessary to guarantee a normal distribution which enabled the subsequent analysis. This process included EFA and CFA. The EFA results were satisfactory, as the KMO value was 0.870.<sup>26</sup> On the CFA, we analyzed two descriptive indices: the CFI and the RMSEA. On model 1, in which there was a significant chi-square value that is naturally related with study sample size, CFA revealed satisfactory fit indexes. The second model, created to test second order latent dimensions, also presents a significant chi-square value, and satisfactory fit indexes. Comparing the overall significance of two exposed models, the chi-square difference test shows that the first order CFA model provides significantly better fit than the second model, considering larger CFI values mean better model fit. This CFI value is very important, since the CFA revealed a significant chi-square value, which rejects the null hypothesis.

## REFERENCES

- Baig LA, Violato C, Crutcher RA. Assessing clinical communication skills in physicians: are the skills context specific or generalizable. *BMC Med Educ.* 2009;9:22.
- Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. *Health Aff.* 2002;21:103-11.
- Horowitz S. Evaluation of clinical competencies. *Am J Phys Med Rehab.* 2000;79:478-80.
- Makoul G, Krupat E, Chang CH. Measuring patient views of physician communication skills: development and testing of the communication assessment tool. *Patient Educ Couns.* 2007;67:333-42.
- Burt J, Abel G, Elmore N, Campbell J, Roland M, Benson J, et al. Assessing communication quality of consultations in primary care: initial reliability of the global consultation rating scale, based on the Calgary-Cambridge guide to the medical interview. *BMJ Open.* 2014;4:e004339.
- Gauchet A, Tarquinio C, Fischer G. Psychosocial predictors of medication adherence among persons living with HIV. *Int J Behav Med.* 2007;14:141-50.
- Sabaté E. Adherence to long-term therapies: evidence for action. Geneva: World Health Organization; 2003.
- Boon H, Stewart M. Patient-physician communication assessment instruments: 1986 to 1996 in review. *Patient Educ Couns.* 1998;35:161-

However, this value is significant mainly due to study sample size.

Regarding internal consistency, measured by Cronbach's alpha, Minho-CAS reveals high consistency for all five dimensions and excellent results if considered the total items of the scale<sup>30</sup> which reflects that Minho-CAS is an appropriate instrument to be used to measure communication.

There are several limitations that should be considered when interpreting these results: i) the design of the study did not allow convergent and divergent validation mechanisms, which could be important to establish construct validity; ii) authors did not assess test-retest reliability and sensitivity to the change of the questionnaire; iii) the number of assessments of each student should be more homogeneous within the sample; iv) students were recruited from a single Medical School; v) the evaluator effect was not assessed in this work; vi) CAS sensitivity for different scenarios was not assessed;

## CONCLUSION

The Minho-CAS captures five important communication skills dimensions with good psychometric properties. The Minho-CAS is a valid scale to assess communication skills by faculty and standardized patients.

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## PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association.

## DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

## CONFLICTS OF INTEREST

All authors report no conflict of interest.

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- 76.
9. Cowan DH, Laidlaw JC. A strategy to improve communication between health care professionals and people living with cancer. I. Improvement of teaching and assessment of doctor-patient communication in Canadian medical schools. *J Cancer Educ.* 1993;8:109-17.
  10. Nørgaard B, Ammentorp JJ, Kofoed PE. Long term follow-up on health care professionals' self-efficacy after communication skills training. *J Nurs Educ Pract.* 2013;3:91.
  11. Makoul G. The SEGUE framework for teaching and assessing communication skills. *Patient Educ Couns.* 2001;45:23-34.
  12. Cohen D, Colliver J, Marcy M, Fried E, Swartz M. Psychometric properties of a standardized-patient checklist and rating-scale form used to assess interpersonal and communication skills. *Acad Med.* 1996;71:S87-9.
  13. Elwyn G, Edwards A, Hood K, Robling M, Atwell C, Russell I, et al. Achieving involvement: process outcomes from a cluster randomized trial of shared decision making skill development and use of risk communication aids in general practice. *Fam Pract.* 2004;21:337-46.
  14. Gillis A, Morris M, Ridgway P. Communication skills assessment in the final postgraduate years to established practice: a systematic review. *Postgraduate Med J.* 2015;91:13-21.
  15. Lenzi R, Baile WF, Berek J, Back A, Buckman R, Cohen L, et al. Design, conduct and evaluation of a communication course for oncology fellows. *J Cancer Educ.* 2005;20:143-9.
  16. Cömert M, Zill JM, Christalle E, Dirmaier J, Härter M, Scholl I. Assessing communication skills of medical students in objective structured clinical examinations (OSCE) - a systematic review of rating scales. *PLoS One.* 2016;11:e0152717.
  17. DiMatteo MR, Hays RD, Prince LM. Relationship of physicians' nonverbal communication skill to patient satisfaction, appointment noncompliance, and physician workload. *Health Psychol.* 1986;5:581-94.
  18. Little P, White P, Kelly J, Everitt H, Gashi S, Bikker A, et al. Verbal and non-verbal behaviour and patient perception of communication in primary care: an observational study. *Br J Gen Pract.* 2015;65:e357-65.
  19. Pereira V, Morgado P, Gonçalves M, Costa L, Sousa N, Cerqueira J. An objective structured clinical exam to assess semiology skills of medical students. *Acta Med Port.* 2016;29:819-25.
  20. World Medical Association. Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA.* 2013;310:2191-4.
  21. Council for International Organizations of Medical Sciences. International ethical guidelines for biomedical research involving human subjects. *Bull Med Ethics.* 2002:17-23.
  22. Hair J, Ringle C, Sarstedt M. PLS-SEM: Indeed a silver bullet. *J Marketing Theory Practice.* 2011;19:139-52.
  23. Peng DX, Lai F. Using partial least squares in operations management research: A practical guideline and summary of past research. *J Oper Manag.* 2012;30:467-80.
  24. Kline RB. Principles and practice of structural equation modeling. 4<sup>th</sup> ed. New York: Guilford Press; 2010. [accessed 2019 apr 30]. Available from: <https://www.guilford.com/books/Principles-and-Practice-of-Structural-Equation-Modeling/Rex-Kline/9781462523344>.
  25. Williams B, Brown T, Onsman A. Exploratory factor analysis: a five-step guide for novices. *JEPHC.* 2010;3:990399.
  26. Kaiser HF. An index of factorial simplicity. *Psychometrika.* 1974;39:31-6.
  27. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Model.* 1999;6:1-55.
  28. Fabrigar LR, Wegener DT, MacCallum RC, Strahan EJ. Evaluating the use of exploratory factor analysis in psychological research. *Psychol Methods.* 1999;4:272-99.
  29. Malkanthe A. Structural equation modeling with AMOS. Mahwah: Lawrence Erlbaum Associates; 2001.
  30. Kim H, Ku B, Kim JY, Park YJ, Park YB. Confirmatory and exploratory factor analysis for validating the Phlegm pattern questionnaire for healthy subjects. *Evid Based Complement Alternat Med.* 2016;2016.
  31. Jones DH. Book review: statistical methods. 8<sup>th</sup> ed. Snedecor GW, Cochran WG, editors. Ames: Iowa State University Press; 1989. p. xix + 491.