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# **Evaluation of knowledge of malnutrition among nursing staff in the Czech Republic: A cross-sectional psychometric methodological study**

## **Abstract**

### **Construct**

The instrument 'Knowledge of Malnutrition - Geriatric 2.0' (KoM-G 2.0) is designed to quantify the degree to which nursing staff have knowledge of aspects related to malnutrition in the specific contexts of inpatient medical and rehabilitation care facilities, as well as home health care. It serves as a tool to gauge their grasp of current clinical practice guidelines, as well as their proficiency in addressing issues related to malnutrition. This measure provides valuable insights into their familiarity with and capacity to tackle issues pertaining to malnutrition in their clinical practice. Furthermore, it helps to assess the effectiveness of educational initiatives and interventions that aim to improve the knowledge and awareness of nursing professionals about malnutrition.

### **Background**

The quality of nursing education affects the assessment of a risk of malnutrition, the monitoring of food intake, and the effectiveness of nutrition interventions.

### **Approach**

The purpose of the study was to translate the KoM-G 2.0, validate the instrument, and evaluate the knowledge of nursing staff about malnutrition in inpatient medical, rehabilitation care facilities, and home care in the Czech Republic.

The research was designed as a cross-sectional psychometric methodological study. All inpatient healthcare facilities and home healthcare facilities in the Czech Republic were invited to participate. An internationally standardized questionnaire 'Knowledge of Malnutrition - Geriatric 2.0' was used in

the Czech version (KoM-G 2.0 CZ) to assess the knowledge of nursing staff in relation to malnutrition. A total of 728 nurses participated in the study; however, 263 questionnaires were not sufficiently filled out. These respondents were excluded from the study population. 465 (63.9%) of the respondents returned complete questionnaires.

### **Findings**

The results included the psychometric characteristics of the KoM-G 2.0 CZ questionnaire, such as the difficulty index Q (0.61), the discriminant index (ULI 0.29, RIT 0.38, upper-lower 30% 0.67), and the reliability calculation using the Cronbach alpha (0.619). The overall mean of correct answers was 6.24 (SD 2.8). Significant differences were found between knowledge in categories according to educational attainment ( $p=0.002$ ) and according to additional nutrition training, compared to those who had not received any training ( $p=0.006$ ).

### **Conclusions**

The results of this study show that KoM-G 2.0 CZ is a useful and valid tool for assessing knowledge about malnutrition. This research identified gaps in nursing knowledge and examples of good practice in understanding malnutrition that can be applied internationally. The knowledge of academic nurses was greater; therefore, they could play a key role in nutritional care. Continuous education is related to a better understanding of malnutrition.

**Keywords:** Malnutrition Awareness; KoM-G 2.0, Nursing Knowledge, Psychometric Assessment, SDG3: Good Health and Well-Being.

## **Main text**

### **Background**

In nursing, core competencies are one of the essential components for providing high-quality nursing care, combining the best scientific knowledge, skilled nursing experience, and patient-centered care, in line with evidence-based nursing. Without a doubt, the core competencies include patient nutrition care, which is practiced on a daily basis.<sup>1</sup> Nutrition care does not only apply to patients at risk of malnutrition, but also to the entire spectrum of hospitalized patients who enter a new environment with a different food mix, are acutely ill, or have decompensation for chronic disease. Furthermore, each new patient should be treated as at risk until proven otherwise using a validated screening tool for the assessment of malnutrition risk, preferably with the evaluation of muscle quantity or quality.<sup>2</sup>

The prevalence of the risk of malnutrition in hospitals ranges from 15% to 70%,<sup>3-6</sup> depending on the group and the country. For patients in home health care or nursing homes, the prevalence of the risk of malnutrition or malnutrition ranges from 47.3% to 84.8%. Values vary widely by age group. In the developed countries and urban areas older people are usually in a higher risk than younger ones.<sup>7,8</sup> However, malnutrition is a global problem that can affect all age groups. The situation can be the opposite in rural areas for low-income families. A systematic review<sup>9</sup> points out that an important risk factor for child malnutrition is, in addition to socioeconomic status, mother's nutrition, mother's education, or the number of family members in one house (including grandparents). The consequences of malnutrition in hospitalized patients are increased mortality rates, long hospital stay, and increased risk of complications such as delayed healing, increased risk of infection, or pressure ulcers.<sup>10,11</sup>

The quality of education of nursing professionals has an impact on the assessment of nutritional risk, the monitoring of dietary intake, and the effectiveness of the nutritional interventions provided.<sup>12</sup> Some relevant nutritional interventions include, for example, helping patients during mealtimes, ensuring appropriate positioning, the use of adequate dentures, and the creation of a comfortable and undisturbed environment. Additionally, nurses supervise the implementation of these conditions by

subordinate staff, despite sometimes reported shortages of resources, such as the lack of nurses and auxiliary staff.<sup>13</sup> Braun<sup>14</sup> point out that improving the quality of undergraduate teaching in relation to nutrition can enhance the effect of nutrition care for patients, improve patient safety, and ensure better interdisciplinary collaboration. Hopkinson<sup>15</sup> notes that post-graduate nursing training needs to be improved in providing nutritional care, as well as in patient education and nutritional support in the course of serious cancer. In a wide range of undergraduate nursing education programs, nutrition is usually a rather minor part of the curriculum.<sup>12</sup>

Improvements in malnutrition education and training are based on determining the current level of knowledge of nursing staff, while benchmarking with other countries can provide valuable insights and comparisons. This approach allows for the identification of areas of excellence in knowledge within specific clinical settings or countries, subsequently enabling the adaptation of these successful areas to other contexts while considering regional disparities. For this purpose, the Knowledge of Malnutrition-Geriatric (KoM-G) questionnaire has been published in the past, which demonstrated differences between the knowledge of nurses and nurse assistants and was the precursor to the introduction of new training courses in malnutrition in Austria.<sup>16</sup> The KoM-G served as a tool to assess their understanding of current clinical practice guidelines and their ability to deal with malnutrition-related issues. This measure provided valuable information on their familiarity with and capacity to address issues related to malnutrition in their clinical practice. In addition, it helped evaluate the effectiveness of educational initiatives and interventions that aim to improve the knowledge and awareness of nursing professionals about malnutrition. After five years, this questionnaire has been updated<sup>17</sup> in the context of changes in standards and clinical guidelines.<sup>18-20</sup>

To maximize the value of the results in nursing practice, it is desirable to conduct a knowledge assessment that ideally addresses all health facilities in a given geographic area or state. However, in the Czech Republic, no nationwide survey of this scale has ever been conducted on the knowledge of nursing staff about malnutrition. Even internationally, most of the knowledge questionnaires on

malnutrition previously used have not been developed based on a standardized methodology, including psychometric tests. Therefore, this study was designed with the main objective of translating the Knowledge of Malnutrition - Geriatric 2.0 Questionnaire into Czech language, validating the instrument, and evaluating the knowledge of nursing personnel about malnutrition in inpatient medical and rehabilitation care facilities and home care in the Czech Republic. From the main objective, three sub-objectives of the research were derived.

### **Objectives**

1. Translate the Knowledge of Malnutrition - Geriatric 2.0 Questionnaire into Czech.
2. Assess the psychometric properties of the KoM-G 2.0 knowledge questionnaire and calculate its reliability.
3. To describe the knowledge of nursing staff of malnutrition.

### **Approach**

#### **Design and Setting**

The research was designed as a cross-sectional psychometric methodological study.<sup>21</sup> The data obtained in the national study in the Czech Republic are also part of a larger study conducted in Austria (AT), Turkey (TR), and The Netherlands (NL). The study was carried out to compare the levels of malnutrition knowledge among nursing staff in Austria, the Czech Republic, the Netherlands, and Turkey and to identify factors associated with this knowledge (e.g.: different educational system, organization of nursing care, continuous postgraduate education). The invitation to participate in the study was distributed using a convenience sampling method.<sup>17</sup> The same procedure for data collection was recommended in all participating countries. All inpatient healthcare facilities (hospitals, aftercare

hospitals, rehabilitation institutions) and home healthcare agencies in the Czech Republic were invited to participate in the research. Facilities were contacted through responsible personnel in the positions of chief nurses, deputy nurses or health care institutions directors. All of them were approached for the survey via their official e-mail addresses. An official list of these facilities was obtained from the Institute of Health Information and Statistics of the Czech Republic.<sup>22</sup> A total of 122 healthcare facilities were contacted.

### **Sample**

This research involved collecting data from nurses who work in nursing practice in the institutions mentioned above. Facilities that wanted to participate in the research forwarded the invitation to their staff email addresses. All respondents received information about the purpose, process, and method of data analysis of the research, including information on data protection and anonymity. The invitation included a web link to complete an electronic questionnaire. Participation was on a voluntary basis. A total of 728 nurses participated in the study; however, some questionnaires (261) were not fully completed and 2 nurses apparently filled out in the wrong year of birth. These respondents were excluded from the study population. 465 (63.9%) of the respondents returned complete questionnaires.

### **Instruments and Data Collection**

Data collection took place between 3 February 2021 and 31 May 2021 using the online platform LimeSurvey. An internationally standardized questionnaire 'Knowledge of Malnutrition - Geriatric 2.0' in the Czech version (KoM-G 2.0 CZ) was used to collect data to assess the knowledge of nursing staff about malnutrition. This questionnaire is based on its first version.<sup>16</sup> The second version of this questionnaire used in the research was created in English in 2020. The items (questions) were based

on current international Clinical Practice Guidelines (CPGs) in 2020.<sup>19,20,23</sup> The relevance of the items for practice was verified using a Delphi study with the calculation of the Item-Content Validity Index (ranged from 81.3% to 100%) as well as the Scale-Content Validity Index (average 94.5%).<sup>17</sup> As part of international cooperation, the English questionnaire was cross-culturally adapted using a standardized forward-backward translation method in the German, Czech, Dutch, and Turkish language. All translations in the participating countries were performed using the same procedure. Cross-cultural adaptation was established according to international guidelines and recommendations.<sup>24-26</sup> For the purposes of this research, only the Czech version of the KoM-G 2.0 CZ questionnaire was used, which was designed to take into account the cultural differences in patient care, the health care system, or nurse education. The entire process of translation and cultural adaptation was continuously consulted by a panel of researchers from all participating countries.

The cross-cultural adaptation of the Czech version of the questionnaire was carried out according to the methodology proposed by all countries involved in the research project in the following steps (aim 1):

1. Forward translation: KoM-G 2.0 has been translated from English to Czech by two people in two independent versions. Both people were native Czech speakers. The first translator was a medical doctor, a specialist in clinical nutrition, who was well acquainted with the topic. The second translator was a professional English linguist. After the two independent translations were produced, a consensus meeting was organized, attended by the two translators mentioned above and two researchers from the field of nursing. The aim of this meeting was to compare the two versions item-by-item and to select the most accurate Czech equivalent to the original English version of the questionnaire and reach a consensus. Everything was done to attempt the highest possible content validity of the translation, cultural differences, and clarity. The result was a unified Czech version of the questionnaire, which was checked for

inaccuracies, unclear interpretations, or double meanings. The entire meeting lasted about 3 hours and all edits were documented.

2. Backward translation: The unified Czech version produced at the consensus meeting was then translated back into the original English and compared with the original. The back-translation was performed by two native English speakers, who also had good command of Czech. One of them worked in the field of nursing, and the other was an English teacher.
3. Expert Committee: The aim of the meeting was to identify potential semantic errors and deviations from the original, thus generating the final Czech version of the KoM-G 2.0 questionnaire. The expert committee meeting was held online, and the participants were all translators of the Czech version and project leaders of the whole international project. This meeting lasted about 1.5 hours and all steps were recorded.
4. Country pilot testing: The comprehensibility of the instructions and questions of the final Czech version of KoM-G 2.0 was verified using a pilot survey supplemented with questions focused on the comprehensibility of the instructions for the respondents and each individual item of the questionnaire. The pilot testing was conducted between November and December 2020 and involved 42 nurses from different settings. All participants in the pilot survey responded to the items as if they were using the questionnaire regularly and then rated the clarity of the questionnaire and its individual sections using clear and unclear responses. All members were allowed and encouraged to use comments to comment verbally on individual items and to propose modifications to the wording of items. Of the total number of participants in the pilot tests, 97.5% found all the items to be understood. No questionnaire item was significantly changed or removed after the pilot testing evaluation. Only two items were partially modified in word order and style.

The original 16-item version of the questionnaire created using the Delphi study was used for data collection. For each knowledge item, one or more answers were correct. The questionnaire was supplemented by seven demographic questions.

## Data Analysis

Data analysis was carried out with SPSS version 26 statistical software.<sup>27</sup> The completeness of all questionnaires was verified, and incomplete questionnaires were excluded from the research sample. All data was double checked when entering the data.

Descriptive statistics were used to evaluate the data. The selected psychometric properties of the questionnaire (Item Difficulty Q, Item Discrimination Index) were calculated and the Cronbach alpha reliability was calculated. These properties indicate the quality of the questionnaire and the usability of its Czech version in practice. Item Difficulty Q indicates the proportion of respondents who correctly answered the question. Low values indicate excessive difficulty, and high values may indicate excessive ease. The Item discrimination index was calculated using three methods for ease of comparability with existing studies. The sensitivity coefficient ULI, the discriminant index RIT and the Upper-lower index 30%, assess the ability of the test item to discriminate between better and worse knowledge of the test takers. The higher the number of these coefficients, the better the item discriminates between test takers with better general knowledge and those with worse general knowledge. However, each of these indicators uses a different approach. The discrimination index in all the calculation variants took values from 0 to 1. The ULI sensitivity coefficient (Upper-Lower-Index) uses the principle of task ability to discriminate between half of nurses with worse and half with better knowledge. The ULI value should not be less than 0.2 except for items with specific purpose which are either too easy or too difficult.<sup>28</sup> The second method was to calculate the discrimination index using the Item-Total Correlation (RIT) coefficient, which assesses the Pearson correlations between a particular test item and the total score. RIT is one of the most widely used tools to assess the strength of discrimination.<sup>29</sup> The discriminative ability of the knowledge questions of the RIT array was categorized as  $\leq 0.2$  poor, 0.21 - 0.24 acceptable, 0.25 - 0.35 good and  $\geq 0.36$  excellent. The third method of calculating the discriminant index was the Upper-Lower index 30%, which compares the knowledge of the best 30%

and the worst 30% of the respondents, ignoring the success rate of the middle 40%.<sup>30</sup> Relationship between the difficulty of the questions and their ability to discriminate between good and bad knowledge was described using the Spearman correlation.

### **Ethical Considerations**

Participation in the investigation was voluntary. All respondents were informed about the purpose of the investigation, the processing of data and the fact that they could interrupt and stop filling out the questionnaire at any time. All were informed about maintaining the anonymity of specific individuals, as well as the anonymity of all health care facilities where the research was carried out. Data protection was standard according to EU Regulation 2016/679 (General Data Protection Regulation).

If some facilities requested additional information, they were provided with all relevant documents (e.g., complete project description). An agreement of the legal ethics committee was not required, because no patients were involved any patients in this study and participation was not mandatory for the employees.

### **Findings**

The first part of the results includes the psychometric properties of the Czech version of the KoM-G 2.0 questionnaire (aim 2). The second part describes the knowledge of nurses (aim 3).

#### **Psychometric properties of the Czech version of Knowledge of Malnutrition - Geriatric 2.0 (KoM-G 2.0 CZ)**

The psychometric properties studied included Difficulty index Q and discriminant index of the questionnaire items (ULI, RIT and Upper-Lower 30%) and reliability calculation using Cronbach alpha. The item analysis of the test parameters is presented in Table 1.

The Mean Item Difficulty Q index was 0.61, which is a medium to high difficulty value. The easiest question had a value of 0.87 and the most difficult had a value of 0.29. ULI values ranged from 0.08 to 0.47 with an average ULI value of 0.29. The RIT discrimination index values ranged from 0.14 to 0.57 with an average of 0.38. The Upper-Lower 30% discriminant index values were consistent with the previous two methods of calculation. The average was 0.40, the minimum 0.14 and the maximum 0.67. All calculation methods indicated the same two questions with lower discriminatory power. The weakest were test item 11 ("In which older persons should food and fluid intake be measured?") and item 4 ("What are possible signs of dehydration?"). The test reliability calculation using Cronbach alpha is 0.619, which is a sufficient reliability value for the purpose of evaluating the performance of a group of respondents. The relationship between the difficulty of the question (Item difficulty value Q) and its ability to distinguish between good and bad knowledge (The Upper-Lower 30% discriminant index) has been assessed by Spearman correlation. The correlation was statistically significant ( $p < 0.05$ ) and negative  $r = -0.54$  (moderate correlation).

The items of highest and lowest score in the survey that indicate areas of knowledge deficit are listed in Table 2. The lowest scoring question (question 5) contained four statements that focused on indications for nutritional screening (12.9% correct responses). The other two questions with high error rates (questions 10 and 11) focused on factors that increase body nutritional requirements (16.8%) and indications to measure dietary and fluid intake (15.9%).

Although the original version of 16-item questionnaires created using Delphi studies was used for data collection, the questionnaires were later reduced to 12 items. Four items (item no. 7, 10, 11 and 16) had Discrimination index or Item difficulty below the recommended values at least in one country that participated in the project (AT, CZ, TR, NL) and were therefore deleted from the final sets of items. The final 12-item Czech version of the questionnaire (KoM-G 2.0 CZ) with correct answers is presented in Appendix 1.

### **Nursing staff knowledge of malnutrition**

The study population consisted of 465 nurses, of which 439 (94.4%) were women, 25 (5.4%) were men, and 1 (0.2%) did not want to specify their gender. The mean age was 46.06 years. The detailed characteristics of the population and the average number of correct responses in the questionnaire are given in Table 3.

The total mean number of correct answers was 6.24 (SD 2.8), with a minimum of 0 and a maximum of 13 correct answers. Seven or fewer correct answers were given by 295 nurses (63.2%). Eight or more, that is, at least half of the questions, were correctly answered by 170 nurses (36.8%). The difference in the number of correct answers in terms of gender distribution was statistically insignificant ( $p=0.417$ ), as was the respondents' length of work experience ( $p=0.378$ ). The assessment of the correct answer based on the nurses' current job title yielded similar results. When all the workplaces are included in the analysis, the differences are statistically insignificant, but this calculation is biased by the disproportionate number of staff in each workplace. However, despite this, a lower number of correct responses is evident in the surgical ward 5.62 (SD 3.18) compared to the geriatric ward 7.24 ( $\pm 2.44$ ).

Statistically significant differences were found in our research between knowledge levels in categories according to educational attainment ( $p=0.002$ ). The highest mean number of correct answers was found in the category of Bachelor's degree (BSc.) 7.33 (SD 2.63) and a Master's or doctorate degree (MSc., Ph.D.) 7.12 (SD 2.45). However, the lowest mean scores were 5.91 (SD 2.76) for General Nurse (Secondary School of Nursing – an old educational system) and Diploma Nurse (Higher Vocational School – post-secondary education) 5.88 (SD 2.76). Nurses who have completed the Practical Nurse educational program, which, since 2014, has been the educational program that replaced the previous General Nurse degree from secondary medical school, achieved a better mean score of 6.31 (SD 3.01) than their predecessors who studied the previous form of this study.

A statistically significantly higher score of correct answers, 7.17 (SD 2.76), was obtained in the group of nurses who had attended courses, training or post-graduate studies in the last two years with a focus on nutrition/malnutrition compared to those who had not received any training in this regard – 6.08 (SD 2.78), ( $p=0.006$ ).

## **Discussion**

The tool is currently available in five languages and therefore allows comparison of knowledge across countries. Through this comparison, it was found that nurses with a university degree had a statistically significantly better knowledge of malnutrition. Nurses who had attended a nutrition course in the last two years prior to data collection also had better knowledge. In the Czech data collection, there were no significant differences between nurses divided into groups according to the length of work experience, age, gender, amount of work time, or workplace.

The psychometric properties of the Czech version of the KoM-G 2.0 questionnaire demonstrated its sufficient quality to assess the knowledge of the respondents. The lowest value of the discriminant index found by RIT was 0.14 for one item, so this item did not have sufficient discriminating power between respondents with better and worse knowledge. However, the average RIT across all items in the test was 0.38, which represents sufficient discriminatory power.<sup>28</sup> According to the ULI calculation, there were two items with low discriminatory ability ( $ULI < 0.2$ ), but the average ULI value for the whole test was 0.29 and the discriminatory ability of the whole test is therefore interpreted as good. The Upper-Lower item discrimination index of 30% corresponded proportionally to the previous two methods of calculation. Between the Item difficulty value  $Q$  and The Upper-Lower 30% discriminant index, a statistically significant moderate negative correlation ( $r=-0,54$ ) was found. This reveals a negative relationship between item difficulty and item discrimination. For the harder items in the questionnaire, the item discrimination skills were improved. In our study, the item difficulty indexes of the items were never too high or too low (0.29-0.87), and the discrimination index of the items (0.14-

0.57) was good, except for the item number 11. The best discriminative ability was found in items that were correctly answered by approximately 50% of the respondents (Table 1).

In the international study with the same instrument,<sup>17</sup> of which this study was a part of, it was found that four items (questions 7, 10, 11 and 16) had a low discrimination index and difficulty index in at least one country of data collection (CZ, AT, TR, NL). Therefore, they were removed from the final set of questionnaire items in all countries. The reason for this is that it was necessary to keep the same final form of the questionnaire in all language versions. However, for this analysis, the primary set of questions (n = 16) was used. The reason for analyzing them is to understand in depth the weak points in the knowledge of the nurses who participated in the data collection in the Czech Republic. The Cronbach alpha reliability was sufficient to assess the knowledge of the respondent group. Based on the above results, the psychometric properties of KoM-G 2.0 CZ were shown to be sufficiently high.

In the analysis of data from the Czech Republic published in this article, the knowledge tested by all 16 items was analyzed. The KoM-G 2.0 questionnaire showed a knowledge deficit, especially in questions focused on indications for nutritional screening (12.9% correct answers). The other two questions with high error rates (Question 10 and 11) focused on factors that increase body nutritional needs (16.8%) and indications to measure dietary and fluid intake (15.9%). These are the same areas where Korean nurses had insufficient knowledge.<sup>31</sup>

Our results show that there was a statistically significant difference in knowledge in the groups divided according to the highest level of education ( $p=0.002$ ). Nurses with university education had the highest KoM-G 2.0 CZ scores. However, there were no significant differences between bachelor's and master's or doctoral degrees. This corresponds precisely with the findings from Austria and the Netherlands, where there were also significant differences between the knowledge of nurses with university degrees and those with lower-attained education.<sup>17</sup> Therefore, we can conclude that improved nutritional care can be achieved by taking a proactive attitude towards adjusting the content of the educational curriculum of undergraduate studies, both in nurse assistants and general nurses.

Furthermore, nurses who attended any postgraduate training (courses) on malnutrition in the past two years had significantly higher knowledge (0.006). Further training in malnutrition had the second highest positive impact on knowledge of malnutrition right after the education degree. Unfortunately, it is not possible to study post-graduate nutrition specialization for nurses in the Czech Republic. Such study programs are not offered by the National Center for Nursing and Non-Medical Health Professions or are only aimed at nutritional therapists.<sup>32</sup> This is a pity for clinical practice, because nutritional care and prevention of malnutrition are, in principle, truly multidisciplinary. Based on our results, as a policy implication, we would recommend establishing new postgraduate courses or study programs for continuous nutrition education for nurses, the curriculum should be assembled on the basis of the latest clinical practice guidelines.<sup>18-20</sup> This is in line with the similar European study by Bauer, where specialized postgraduate training in malnutrition/nutrition for nurses was proven to improve nurses' knowledge more than three times (regression coefficient 3.696, CI 1.493–5.899).<sup>17</sup>

The KoM-G 2.0 questionnaire is intended primarily for benchmarking, comparison, and identify problem areas in the nursing staff knowledge of malnutrition. For this reason, the questionnaire items were based on the most current guidelines at the time of its development and were set at a relatively high difficulty level (Item Difficulty Q index 0.61). Even the more knowledgeable nurses made errors in some answers, making the entire test able to sufficiently differentiate between levels of knowledge. However, these errors were not intended to indicate the ignorance of particular individuals, but to determine which areas of knowledge were generally inferior in relation to malnutrition. Thus, from the errors of the whole group of respondents, appropriate measures are found to increase knowledge and subsequently also competence in practice. Comparison of results nationally and internationally and highlighting gaps serves to increase interest in further study and self-education of nurses. According to Bevan<sup>33</sup>, benchmarking is always a strong motivating factor in itself and can be a 'drive' that changes attitudes and intrinsic motivation of healthcare workers. Higher motivation often leads to better attitudes of health care professionals. Laur<sup>34</sup> pointed out the attitude of health professionals towards malnutrition. The respondents attributed neutral or negative priority to it in 43% of the cases, and in

94% of the cases respondents had a neutral or negative attitude towards the need for individualized care by a nutrition therapist for patients with malnutrition. Thirty-five percent of the respondents were uncertain of the indications to contact nutrition therapists and 40% were uncertain when a patient was malnourished or at risk of malnutrition.<sup>34</sup>

Studies usually assess nurses' knowledge of nutrition cross-sectionally.<sup>31,34,35</sup> Thus, it is not apparent whether there is a trend toward greater knowledge following, for example, the promotion of new guidelines or changes in legislation related to nurse education. To assess the trend in knowledge, it would be useful to establish a periodic data collection once every 5 years to assess the development in knowledge in relation to malnutrition. Similarly, to further increase interest and participation in research, it may be appropriate to conduct national benchmarking at periodic intervals to assess differences between regions or between health facilities. Evaluating trends over time would show how knowledge of health workers has improved due to increased interest and additional training courses. In the same way as malnutrition, other areas of knowledge that are closely related to the quality of nursing care could receive the same attention. However, it is essential when making such comparisons that the results are not followed by overly harsh or restrictive measures. One of the broadest forms of benchmarking in malnutrition is sought to be implemented by ESPEN with a focus on quality and economic indicators of nutritional care in hospital as part of the *nutritionDay* campaign.<sup>36</sup>

During the data collection analysis, it was found that a relatively large number of nurses (261) stopped completing the knowledge questionnaire in the course of the data collection. It is possible that nurses who felt that their knowledge was at a good level or who answered the questionnaire items without much difficulty were more likely to proceed with the completion of the questionnaire. Rudžionienė<sup>37</sup> have shown that respondents most often abandon questionnaires in the course of completing them because of their length, focus or experience. The KoM-G 2.0 CZ questionnaire had a total of 16 items. We do not consider it to be too long. Furthermore, based on psychometric analysis, it was shortened to 12 items for future use. However, the analysis of the responses showed that only 36.83% of the

respondents answered at least half of the items correctly and the difficulty Q value was 0.61. Therefore, we assume that some respondents lost motivation to continue the questionnaire due to its difficulty, which may have resulted from their poorer knowledge of the current Clinical Practice Guidelines of the respondents. Based on international data collection in all four countries, four items were found to be difficult with a low number of correct answers and, at the same time, had a low discrimination index. Therefore, these questions could not discriminate sufficiently between nurses with better and worse knowledge, because they were incorrectly answered even by nurses who otherwise scored above average.<sup>17</sup>In future studies, the questionnaire with 12 items will be used, which can ensure a higher willingness of future respondents to complete the questionnaire to the end.

In terms of the data collection timeline in our study, its planning was restricted by the circumstances of the Covid-19 pandemic. This constraint may have had an impact on the outcomes, as the pandemic, as reported by the Czech National Control Center for Acute Inpatient Care<sup>38</sup>, imposed significant burdens on almost all inpatient facilities. In the context of the study results, the pandemic could have influenced not only the quantity of completed questionnaires, but also, to some extent, their results. This influence could be attributed to increased stress among nurses during the pandemic, changes in work organization, or changes in nurses' priorities, with the perception of questionnaire completion as less crucial than patient care.

### **Limitations of the Research Study**

The limitations of this research include the relatively low number of health facilities and nurses who participated in data collection. This was mainly due to data collection during a period when there was a relatively high increase in the number of hospitalized patients with Covid-19 infection in the Czech Republic. This may have affected the willingness of nurses or middle management staff to complete the questionnaires. Therefore, the results of the survey cannot be generalized. However, the data

obtained provide important insights into the evaluation of the knowledge of nurses. A strong point is the identification of statistically significant factors related to nurses' knowledge of malnutrition.

## **Conclusions**

The results of this study show that the KoM-G 2.0 CZ is a useful and valid tool for assessing and comparing the knowledge of nursing staff in relation to malnutrition. Its items are based on updated standards of nutritional care. The suitability of the instrument was verified by calculating its psychometric properties, which have been proven to be of a high standard.

In conclusion, the knowledge of malnutrition of academic nurses in the Czech Republic is greater; therefore, they could play an even more important role in nutritional care. Continuous education is also very important, related to better up-to-date knowledge about malnutrition. However, this information should be taken as motivational and should be a driving force to ensure more attention and better development of malnutrition education at different levels of nursing studies in the Czech Republic and possibly other countries that will be involved in benchmarking nurses' knowledge about malnutrition in the future.

Based on the statistically significantly higher knowledge of nurses who have completed courses on malnutrition in previous years, we can recommend and support the development and initiation of post-graduate courses or specializations for nurses. In addition to evaluating knowledge using a validated tool, the purpose of this research was also to raise awareness of the importance of up-to-date knowledge about malnutrition and to allow international comparison of results found using the same tool. The more states and health care facilities involved in this evaluation, the more telling the results would be.

## **Declaration of interest**

The authors declare that they have no known competing financial interests or personal relationships that could appear to influence the work reported in this paper.

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## Appendix 1: KoM-G 2.0 CZ

### Znalosti o malnutrici – Geriatrický dotazník 2.0

Prosím, přečtěte si pečlivě otázky a odpovědi a zaškrtněte ty, které se nejlépe shodují s vaším názorem. Prosím, vezměte na vědomí, že je možné zaškrtnout více správných odpovědí. Pokud odpověď neznáte, prosím, zaškrtněte „Nevím“. Žádáme vás o vyplnění kompletního dotazníku, abychom získali komplexní přehled o znalostech sester. Prosím nepoužívejte jiné zdroje (jako internet nebo knihy) a neporovnávejte své odpovědi s odpověďmi vašich kolegů/kolegí.

#### 1. Jaké jsou možné rizikové faktory pro vznik malnutrice?

- Deprese \*
- Inkontinence
- Nádorové onemocnění \*
- Polypragmázie (užívání více než 5 léků denně) \*
- Nevím

#### 2. Jaké jsou možné důsledky malnutrice?

- Zvýšená tepová frekvence
- Zvýšená vnímavost k infekcím \*
- Zhoršená mobilita \*
- Zhoršené hojení ran \*
- Nevím

#### 3. Jaké jsou možné příznaky malnutrice?

- Nechtěný váhový úbytek \*
- Snížená chuť k jídlu \*
- Snížená svalová síla \*
- Vysoký krevní tlak
- Nevím

#### 4. Jaké jsou možné známky dehydratace?

- Deprese
- Koncentrovaná moč\*
- Průjem
- Sucho v ústech\*
- Nevím

#### 5. Která tvrzení ohledně screeningu rizika malnutrice jsou správná?

- Riziko malnutrice by mělo být hodnoceno u všech křehkých seniorů. \*
- Riziko malnutrice by mělo být hodnoceno validovaným nutričním screeningovým nástrojem. \*
- Riziko malnutrice by mělo být hodnoceno za použití laboratorních parametrů.
- Riziko malnutrice by nemělo být hodnoceno u seniorů s nadváhou.
- Nevím

6. Které z následujících indikátorů by měly být zahrnuty ve screeningu malnutrice?
- Nechtěný váhový úbytek \*
  - Albumin
  - Nutriční příjem \*
  - BMI (Body Mass Index, Index tělesné hmotnosti) \*
  - Nevím
7. Která tvrzení ohledně spolupráce různých zdravotnických profesionálů v nutričním týmu jsou správná?
- Role a úkoly různých zdravotnických profesionálů by měly být jasně definovány \*
  - Denní porady nutričního týmu jsou nezbytné.
  - Nutriční tým by měl zahrnovat nutriční terapeutů, lékaře, sestry a farmakology. \*
  - Používání klinických doporučených postupů a standardů může usnadnit multidisciplinární týmovou spolupráci v nutričním týmu. \*
  - Nevím
8. Celkové denní nároky na tekutiny u seniora...
- ... jsou za normálních okolností 1300 ml.
  - ... jsou za normálních okolností 30-35 ml na kilogram tělesné hmotnosti. \*
  - ... jsou za normálních okolností 1 litr.
  - ... se u určitých nemocí mění. \*
  - Nevím
9. Co by mělo být zohledněno během příjmu stravy seniorů?
- Vhodná asistence během jídla \*
  - Atraktivní servírování jídel \*
  - Správná poloha vsedě \*
  - Vhodná zubní náhrada \*
  - Nevím
10. Která tvrzení ohledně léčby malnutrice jsou správná?
- Všechny nutriční intervence by měly být zahájeny co nejdříve. \*
  - Sondová nebo parenterální výživa by měly být použity u všech podvyživených seniorů.
  - Jednou z prvních intervencí je obohacení stravy o kalorie a/nebo živiny. \*
  - Je důležité identifikovat potenciální příčiny malnutrice, aby se naplánovaly intervence na míru. \*
  - Nevím
11. Co je důležité ohledně používání perorálních nutričních doplňků u seniorů?
- Seniorům v riziku malnutrice nebo v malnutrici by měly být nabízeny perorální nutriční doplňky, pokud nejsou ostatní intervence efektivní. \*
  - Perorální nutriční doplňky by neměly být podávány osobám s mírným kognitivním postižením.
  - Perorální nutriční doplňky by měly být užívány maximálně 2 týdny.
  - Chuť a konzistence perorálních nutričních doplňků by měla být přizpůsobena preferencím starších osob. \*
  - Nevím

12. Která tvrzení o sondové a parenterální výživě jsou správná?

- Sondová výživa by měla být používána u seniorů v terminálním stádiu.
- Sondová výživa by měla být používána, pokud se předpokládá, že perorální příjem nebude možný více než 3 dny. \*
- Pokud bylo déle než týden naplněno méně než 50 % nutričních nároků perorálním příjmem nebo enterální výživou, měla by být použita parenterální výživa. \*
- Sondová výživa by měla být použita u osob, které trpí alespoň 3 dny ztrátou chuti k jídlu.
- Nevím

## Tables

**Table 1 Analysis of test parameters items (N = 465) sorted by Item difficulty value from highest (most correct answers) to lowest.**

Item number	Item difficulty value Q - Item difficulty index	ULI sensitivity coefficient	Discrimination Index (RIT)	Discrimination index (Upper-Lower 30%)
5	0.87	0.18	0.27	0.25
11*	0.84	0.08	0.14	0.14
10*	0.83	0.22	0.34	0.27
9	0.78	0.25	0.37	0.35
15	0.72	0.28	0.36	0.37
1	0.69	0.25	0.37	0.42
6	0.69	0.27	0.33	0.41
8	0.69	0.35	0.43	0.46
16*	0.67	0.34	0.44	0.56
12	0.51	0.39	0.43	0.45
13	0.48	0.47	0.57	0.67
2	0.47	0.35	0.45	0.53
14	0.46	0.46	0.54	0.62
4	0.44	0.15	0.21	0.26
7*	0.34	0.23	0.35	0.39
3	0.29	0.31	0.43	0.43

\* Items marked with an asterisk have been removed from the final version of KoM-G 2.0.

**Table 2 Correct answers of responses to individual items of the KoM-G 2.0 CZ questionnaire (N=465).**

Number	Wording of the item	Number of correct answers (n)	Percentage of correct answers (%)
1	What are possible risk factors for malnutrition?	143	30.8
2	What are possible consequences of malnutrition?	248	53.3
3	What are possible signs of malnutrition?	331	71.1
4	What are possible signs of dehydration?	259	55.7
5	Which statements on malnutrition risk screening are correct?	60	12.9
6	Which of the following indicators should be included in nutritional screening?	143	30.8
7	When should a screening for malnutrition be conducted in older persons? *	307	66.0
8	Which statements on the collaboration of different health professionals in a nutrition support team are correct?	144	31.0
9	The daily total fluid requirement of an older person...	103	22.2
10	Which of the following factors can cause increased energy and nutrient requirements? *	78	16.8
11	In which older persons should food and fluid intake be measured? *	74	15.9
12	What should be considered during older persons' food intake?	226	48.6
13	Which statements about the treatment of malnutrition are correct?	240	51.6
14	What is important regarding the use of oral nutritional supplements in older persons?	266	57.2
15	Which statements on tube feeding and parenteral nutrition are correct?	128	27.5
16	What should be considered regarding the nutritional therapy in older persons at the end of life? *	153	32.9

\* Items marked with an asterisk have been removed from the final version of KoM-G 2.0.

**Table 3 Demographic characteristics and mean number of correct answers (N=465).**

Variable	Absolute frequency	Relative frequency (%)	Mean percentages of correct answers (%)	Mean number of correct answers (SD)	p= (Kruskal-Wallis test)
<b>Gender</b>					
Male	25	5.4	41.7	6.76 (±3.07)	0.417
Female	439	94.4	38.8	6.21 (±2.79)	
Does not want to specify gender	1	0.2	50.0	8	
<b>Education attained</b>					
Secondary School of Nursing - Practical Nurse	35	7.5	39.4	6.31 (±3.01)	0.002
Secondary School of Nursing - General Nurse	250	53.8	37.0	5.91(±2.76)	
Diploma nurse	34	7.3	36.8	5.88(±2.76)	
Bachelor's degree	60	12.9	45.8	7.33 (±2.63)	
Master's or doctoral degree	49	10.5	44.5	7.12 (±2.45)	
Other	37	8.0	36.5	5.84 (±3.07)	
<b>Length of work experience</b>					
Up to 5 years (<5)	37	8.0	39.2	6.27 (±2.59)	0.378
5 to 10 years	42	9.0	42.7	6.83 (±2.48)	
More than 10 years	386	83.0	38.6	6.18 (±2.85)	
<b>Type of workplace (department)</b>					
Hospital – surgical ward	34	7.3	35.1	5.62 (±3.18)	0.692
Hospital – internal medicine ward	49	10.5	38.5	6.16 (±2.44)	
Hospital – intensive care unit	51	11.0	40.7	6.51 (±2.84)	
Hospital – geriatric ward	17	3.7	46.4	7.24 (±2.44)	
Hospital – other	222	47.7	39.2	6.27 (±2.82)	
Home care	7	1.5	32.1	5.14 (±2.91)	
Rehabilitation	30	6.5	39.6	6.33 (±2.83)	
Other	55	11.8	38.3	6.13 (±2.85)	
<b>Working hours</b>					
Up to 10 hours weekly	7	1.5	48.2	7.71 (±1.89)	0.199
11 to 20 hours weekly	17	3.7	42.6	6.82 (±2.21)	
21 to 30 hours weekly	24	5.2	34.1	5.46 (±2.92)	
31 and more hours weekly	417	89.7	39.0	6.24 (±2.82)	
<b>Attended a course or training on malnutrition in the past 2 years</b>					
Yes	70	15.0	44.8	7.17 (±2.76)	0.006
No	395	85.0	38.0	6.08 (±2.78)	
<b>Overall test success rate</b>					
Up to 50 %	295	63.2			

50 % and more	170	36.8			
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