PSYCHOMETRIC TESTING OF PERCEIVED IMPLICIT RATIONING OF NURSING CARE (PIRNCA)

Short running title: Psychometric testing of the PIRNCA instrument

Dominika KALÁNKOVÁ[1], Riitta SUHONEN[2,3], Minna STOLT[2], Radka KURUCOVÁ[1], Jouko KATAJISTO[4], Katarína ŽIAKOVÁ[1], Elena GURKOVÁ[5]

[1] Department of Nursing, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, Slovak Republic

[2] Department of Nursing Science, University of Turku, Turku, Finland

[3] Turku University Hospital, and City of Turku, Welfare Division, Turku, Finland

[4] Department of Mathematics and Statistics, University of Turku, Turku, Finland

[5] Department of Nursing, Faculty of Health Sciences, Palacký University, Olomouc, Czech Republic

Dominika Kalánková, RN, MSc, PhD-c

Department of Nursing, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, 03601 Martin, SLOVAKIA

ORCID: 0000-0003-3396-3519

kalankova1@uniba.sk

Riitta Suhonen, RN, PhD, Professor

University of Turku, Department of Nursing Science and Director of Nursing, Turku University Hospital, and City of Turku, Welfare Division

University of Turku, Department of Nursing Science, 20014 University of Turku, FINLAND.

ORCID: 0000-0002-4315-5550

riisuh@utu.fi

Minna Stolt, Podiatrist, PhD, Docent, University Lecturer

University of Turku, Department of Nursing Science

University of Turku, Department of Nursing Science, 20014 University of Turku, FINLAND.

ORCID: 0000-0002-1845-9800

minna.stolt@utu.fi

Radka Kurucová, RN, PhD, University Lecturer

Department of Nursing, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, 03601 Martin, SLOVAKIA
Radka.Kurucova@jfmed.uniba.sk

Jouko Katajisto, MSocSci, Statistician, Senior Lecturer
University of Turku, Department of Mathematics and Statistics, 20014 University of Turku, FINLAND
jouko.katajisto@utu.fi

Katarína Žiaková, RN, PhD, Professor
Department of Nursing, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, 03601 Martin, SLOVAKIA
Katarina.Ziakova@jfmed.uniba.sk

Elena Gurková, RN, PhD, Associated Professor
Department of Nursing, Faculty of Health Sciences, Palacký University in Olomouc, Olomouc, CZECH REPUBLIC
Elena.gurkova@upol.cz

Corresponding author

Dominika Kalánková, RN, MSc, PhD-c
Department of Nursing, Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava, 03601 Martin, SLOVAKIA
ORCID: 0000-0003-3396-3519
kalankova1@uniba.sk

Acknowledgements
Supported by the project COST Action CA 15208 Rationing Missed Nursing Care: An international and multidimensional problem.

Author contribution
All listed authors confirm that they participated in the development of the manuscript in the following ways: conception and design or analysis and interpretation of the data; drafting the

article or revising it critically for important intellectual content, and final approval of the version to be published.

Conflict of interest

No conflict of interest has been declared by the authors.

Ethical considerations

The study was approved by the Ethical committee of the Jessenius Faculty of Medicine in Martin, Comenius University in Bratislava (EK 2030/2017).

Author Contributions:

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;

2) drafting the article or revising it critically for important intellectual content.

PSYCHOMETRIC TESTING OF PERCEIVED IMPLICIT RATIONING OF NURSING CARE (PIRNCA) IN SLOVAK UNIVERSITY AND FACULTY HOSPITALS

ABSTRACT

Aims: To evaluate the psychometric properties of the Perceived Implicit Rationing of Nursing Care (PIRNCA) instrument and to report the prevalence of rationed care at university and faculty hospitals.

Design: A cross-sectional study.

Methods: The study was carried out at two university and five faculty hospitals in the Slovak Republic. Participants were 895 registered nurses recruited by the purposive sampling method between December 2017 and July 2018. Data were collected using the PIRNCA instrument. Construct validity and reliability of the instrument were tested.

Results: The prevalence of rationed care at university and faculty hospitals was identified as being 42.1 %. Furthermore, 87.6 % of nurses reported rationing one or more nursing care activities. Using both statistical methods when evaluating the PIRNCA resulted in the confirmation that the tool is valid and reliable.

Conclusion: Rationed care is a common phenomenon at university and faculty hospitals. The PIRNCA is a suitable instrument to measure the phenomenon in adult acute care units because of its high reliability and validity. We recommend using the instrument in different contexts, not only for specific conditions that were presented for this study.

Impact:

- **What problem did the study address?**
    - Rationed care at university and faculty hospitals has never been reported.
    - Psychometric properties of the instrument that measures nurses´ perception of rationed care have never been evaluated by using different approaches.
- **What were the main findings?**
    - The most frequently rationed nursing care activities are those that nurses are competent to initiate on the basis of their knowledge and skills – the independent ones.
    - The PIRNCA is a valid and reliable instrument.
- **Where and on whom will the research have an impact?**
    - Hospital management can use the instrument to explore the prevalence of rationed care, followed by the application of prevention strategies.
    - Our findings represent the base for further exploration of rationed care using the PIRNCA.

Keywords: "nurses", "rationing of care", "PIRNCA instrument"; "Rasch analysis"; " faculty hospitals"; "university hospitals"; "psychometric properties"

Main paper

INTRODUCTION

"Rationing of care" or "rationed care" are often used terms in healthcare systems around the world (Jones, 2014). In detail, the phenomenon was described primarily in medical disciplines and was used to refer to resource allocation (Herlitz, 2016; Strech & Danis, 2014; Williams, 1980). Resource allocation illustrates general funds that have implications for labour and material resources that are necessary for providing care to patients. Concerning resource allocation, we encountered two types of care rationing – explicit (external) or implicit rationing (hidden). Explicit rationing is generally associated with the economics of health care systems and addresses cost-reductions (Jones, 2014; Jones, 2015; Papastavrou, Andreou & Efstathiou, 2014). Jones (2014) described the rationing of care in the context of the decision-making process at particular levels in the healthcare system. As the first aspect, she identified decisions made at the macro-level, which are political by nature and fall within the competencies of the government and healthcare authorities in a particular country. Decisions made at meso-level are the responsibility of healthcare facilities as a part of the organisational aspects of the system that involve the allocation of financial resources. Last, decisions that are made at the micro-

level usually involve the actual healthcare professionals that are responsible for them (Diagram 1). Decisions produced at the macro- and meso-level are administrative and political in nature and therefore are considered as a form of explicit rationing. On the contrary, decisions made at the micro-level are directly related to patients and depend on the experiences and considerations of the specific situation evaluated by the individual healthcare professionals responsible and thus are considered as a form of implicit rationing (Jones, 2014; Jones, 2015).

Regarding nursing, implicit rationing concerns of nurses and what is associated with ethical and moral aspects of the subject in question (Schubert, Glass, Clarke, Schaffert-Witvliet & De Geest, 2007; Suhonen et al., 2018). However, according to Scott et al. (2018), rationing of care is still not a common term used in nursing science. In relation to nursing, rationing of nursing care was first identified by Schubert et al. (2007) in the Rationing of Nursing Care study conducted in Switzerland which aimed to map the levels of care provided in Swiss acute care settings (Schubert et al., 2008). Schubert et al. (2007, p. 417) also clarified the concept of rationing and defined it as "withholding of or failure to carry out any necessary nursing activities for patients from the reason of insufficient resources (skill-mix, personnel, time)."

Moreover, authors (Schubert et al., 2007) developed the specific conceptual framework of rationing of nursing care which accompanies factors influencing the decision-making process, nurses, and prioritisation of nursing care as well as nursing and patient outcomes. The conceptual framework illustrates that rationing of care is a result of the occurrence when nurses do not have the sufficient resources to ensure the adequate care to patients (Schubert et al., 2008; Schubert et al., 2013). Therefore, nurses are forced to prioritise their tasks which can result in adverse patient outcomes or decreased quality of care provided (Schubert et al., 2008).

Background

The phenomenon of rationed nursing care was examined primarily in a European context, chiefly in Switzerland, to be precise (Dhaini et al., 2017; Schubert et al., 2007; Schubert et al., 2013; Zúñiga et al., 2015). Nursing care activities being often rationed by nurses include emotional support, education of the patient or a family, documentation of provided care, communication with the patient, basic activities such as ambulation with the patient, hygiene care, turning or feeding (BLINDED FOR PEER REVIEW). Withholding of these activities results in adverse patient outcomes, such as falls and pressure ulcers (Schubert et al., 2008; Schubert et al., 2009), patient mortality (Schubert, Clarke, Aiken & De Geest, 2012), and relates to the healthcare concerns such as quality of provided care and patient safety (Cho et al., 2016). Only a few studies have explored the prevalence of rationed care in an American context (Jones, 2014; Jones, Gemeinhardt, Thompson & Hamilton, 2016; VanFosson, Jones & Yoder, 2018; Zeleníková et al., 2019). According to Jones et al. (2016), the prevalence of rationed nursing care varied from 55% to 98% when taking into account one or more nursing care activities being rationed by nurses. There is a gap in the literature regarding the rates of prevalence, and all of the previous studies are mainly focused on the specific nursing care activities being rationed.

In nursing, several instruments have been developed for measuring rationed nursing care in different countries and contexts. These instruments are not limited to specific care

systems or models and may be considered generally usable. However, instruments measuring rationed nursing care differ in included categories of nursing care activities, the number of items, response options and scoring (Jones, Hamilton & Murry, 2015; BLINDED FOR PEER REVIEW). Based on the previously mentioned conceptual framework, a specific measuring tool to measure the phenomenon has been developed in Switzerland – the Basel Extent of Rationing of Nursing Care (BERNCA) instrument (Schubert et al., 2007). The BERNCA instrument consists of twenty items that are focused on necessary nursing care activities. Items in the BERNCA instrument refer mainly to necessary nursing care activities, such as patient education, hygiene care or documentation and coordination of nursing care. These items are grouped into five theoretical subscales. The tool was especially tested in acute care settings. Later it was revised and published as BERNCA-R (Schubert et al., 2013). Since then, the tool has been adapted for use in nursing homes and introduced as BERNCA-NH (Zúñiga et al., 2015; Zúñiga et al., 2016). Also, the instrument was translated into several languages (French, Greek, and English) and subsequently tested in a few European countries, mainly in Switzerland (Dhaini et al., 2017; Schubert et al., 2008; Schubert et al., 2009; Schubert et al., 2013; Schubert et al., 2013; Zúñiga et al., 2015). Based on a psychometric properties evaluation, the BERNCA instrument has been found to be a valid and reliable tool (Schubert et al., 2007). Another instrument developed in Canada for measuring rationed care was the Neonatal Extent of Work Rationing (NEW-RI) instrument (Rochefort & Clarke, 2010). This particular instrument was adapted especially for use in the settings of neonatal intensive care units (NICU), and it consists of fifty-two items divided into four subscales. Items in this instrument focus on specific nursing care activities related to a setting of NICU. The NEW-RI instrument has been translated into English and French and used only twice in actual practice, but its psychometric characteristics have been proven to be satisfactory (Rochefort & Clarke, 2010; Rochefort, Ratwell & Clarke, 2016). The latest instrument developed to measure the phenomenon was the Perceived Implicit Rationing of Nursing Care (PIRNCA) instrument, which is a modified version of the BERNCA tool (Jones, 2014). This tool was adapted to be used by American medical-surgical nurses due to the scope of their competencies (Jones, 2014; Jones, 2015; Jones et al., 2016). It consists of thirty-one items and has not been divided into subscales as of yet. The instrument includes necessary as well as specific nursing care activities that are performed by RNs who provide nursing care to adult patients. The PIRNCA instrument was used only a few times in the USA (Jones, 2014; Jones et al., 2016; VanFosson et al., 2018). However, items in the instrument reflect the scope of the competencies of the Slovak nurses, so the instrument was more than appropriate to use in the Slovak settings. In the Slovak Republic, the instrument was translated and piloted for use in acute care settings (BLINDED FOR PEER REVIEW). The instrument was translated from English to Slovak using forward-backward translation. No modifications were made in the translated version. Findings from the pilot study indicated that the most rationed activities are those related to the emotional support, communication within the multidisciplinary team, and documentation of nursing care. These results were supported in our study also.

However, there is a gap in the literature concerning the use of the PIRNCA instrument in specific settings. The focus of our study was to use the PIRNCA instrument and test it within the particular context of acute care settings in some of the largest university and faculty hospitals in respect to the provision of nursing care to adult patients, focusing primarily on

medical-surgical, geriatric and intensive care units in the Slovak Republic. Differences are also expected between rationed care in university hospitals and faculty hospitals. In the Slovak Republic, university hospitals represent the largest hospitals across the country located near medical universities, which educate especially medical and nursing students. The workload of nurses working at university hospitals is thus higher compared to nurses working in faculty hospitals which are not only smaller, but the ratio of students is lower during shifts.

In previously reported studies, the psychometric properties were considered to be at an excellent level (Jones, 2014; VanFosson et al., 2018; Zeleníková et al., 2019). In two of the studies (Jones, 2014; Zeleníková et al., 2019), the factorability of the PIRNCA instrument was assessed by a review of communalities, Bartlett's test of sphericity, the Kaiser-Meyer-Olkin measure of sampling adequacy as well as an inter-item correlation matrix. According to the positive factorable matrix, Principal Component Analysis with a pairwise exclusion for missing data was applied with the aim of factor extraction. In Jones' study (2014), three factors were identified depending on the eigenvalues greater than one. Based on the scree plot, only a single dominant factor emerged which proved to have a stable factor loading. These results were similar compared to the parent BERNCA instrument where five factors emerged but only one was confirmed to have a stable structure (Schubert et al., 2007). Zeleníková and colleagues (2019) have recently explored the psychometric properties of the PIRNCA instrument in four central European countries - Slovak Republic (note - general hospitals), Czech Republic, Poland, and Croatia. The authors followed the original study of Jones (2014) and applied the same procedures that revealed a six-factor solution for the Czech version, a four-factor solution for the Slovak and Polish versions and a five-factor solution for the Croatian version. Repeatedly, the scree plot did not support multiple factors in the PIRNCA instrument (Zeleníková et al., 2019). Nonetheless, the Cronbach alpha has ranged from 0.86 to 0.98 across the mentioned studies conducted in different settings (Jones, 2014; VanFosson et al., 2018; Zeleníková et al., 2019). However, no study has tested construct validity and reliability of the PIRNCA instrument by using different approaches, such as Principal Component Analysis and the Rasch analysis at the same time. There is naturally a lack of knowledge in relation to the in-depth exploration of its psychometric properties. Likewise, although the factorability of the PIRNCA instrument is arguable, it is necessary to explore this issue further by using different approaches as well.

THE STUDY

Aims

- To evaluate the psychometric properties, explicitly, construct validity and reliability of the PIRNCA instrument using different approaches.
- To report the prevalence of rationed nursing care at university and faculty hospitals across the Slovak Republic.

Research questions

- What are the psychometric properties of the PIRNCA instrument, and what findings may bring a combination of the use of different approaches, such as Principal Component Analysis and the Rasch analysis?

- What is the prevalence of rationed nursing care at university and faculty hospitals in the Slovak Republic?

Design

The cross-sectional study design was used to investigate rationed nursing care at university and faculty hospitals across the Slovak Republic.

Sample/Participants

All university (n=3) and faculty hospitals (n=8) in the Slovak Republic were asked to participate in this research. Two of three university hospitals and five of eight faculty hospitals gave written consent to conduct the study. Only fully qualified nurses were included in the study. Nurses were included if they worked as registered nurses (RNs) in acute care settings, at various care units (medical, surgical, intensive care units, geriatrics), provided care to adult patients, and were shift-working. Nurses who worked at paediatrics or gynaecology/obstetrics care units and/or had occupied managerial positions were excluded from the study entirely. The PIRNCA instrument was developed for bedside RNs who provide direct nursing care to adult patients, excluding gynaecology/obstetric care within which RNs have specific competencies not included in the instrument. A convenience sample of registered nurses was recruited within each of the participating hospitals. All registered nurses from the addressed care unit types were invited to participate in the study.

To determine adequate sample size, an online sample size calculator (Qualtrics®) was used. In the Slovak Republic, there are approximately 40 000 nurses. We used the confidence interval of 95% and, due to the size of the sample, the study obtains a margin of error of ±5%. The sample size was set to be at a minimum of 391 respondents.

Data collection

Data collection for the study was realised in the time period between December 2017 and July 2018. During the first step of the data collection process, a written application with attached measures, approval of the Ethical Committee and further written information for the selected group of nurses was sent to their nursing directors (nurse managers) or the directors of the selected hospitals. After receiving the required permissions to conduct the proposed research, the nursing directors were also asked to participate in the data collection process. In three of the selected hospitals, the instruments used for the research were distributed by the nursing directors within the selected departments, in four hospitals the questionnaires used for the research were distributed via head nurses of each of the particular care units or departments. All nurses working in selected care units or departments who met the inclusion criteria were asked to participate in the research. The questionnaire packets included a cover letter with the invitation to participate in the study and a 54-item questionnaire. The cover letter explained the purpose of the research and confirmed that participation was voluntary. Furthermore,

procedures to protect confidentiality were explained. To ensure the anonymity of the participants, drop boxes for the submission of completed questionnaires were prepared in the nurses' stations at each care unit or department. These boxes were available in the nurses' workplaces for two weeks since the questionnaires were distributed. Finally, these boxes were picked up by the researcher in person in all of the above-mentioned care units or departments from all hospitals included in the research. Overall, 1456 questionnaires were distributed within the approved seven university and faculty hospitals. In turn, the number of returned questionnaires was 896, excluding one of the questionnaires due to its incompletion. As a result, altogether 895 questionnaires were analysed, resulting in a response rate of 61.47 %.

Measurements

Data was collected via the PIRNCA instrument that measures nurses' perception of rationed nursing care (Jones, 2014). Comparing to the previously discussed BERNCA instrument, PIRNCA is seen as more suitable for use in the Slovak care setting and system because it better reflects the scope of the competencies of the Slovak RNs – as opposed to the BERNCA instrument which includes mainly basic nursing care tasks and activities. The PIRNCA instrument is a self-assessment tool designed for use by registered nurses. The PIRNCA instrument consists of 31 items including activities related to assistance with physical care, implementation of a prescribed treatment plan, emotional support and education, patient surveillance, coordination of care and discharge planning, and documentation of care. However, multiple factors in the instrument have not been supported in the literature so far. In the instrument, participants are asked to rate the frequency with which care tasks and activities were not completed during the past seven working shifts on a 5-point frequency scale (0 – "not needed", 1 – "never", 2 – "rarely", 3 – "sometimes", 4 – "often"). The operational definition for rationed care activities is the response of "rarely" to "often". It also contains an open-ended question: "Is there anything you would like to share about your ability to complete necessary nursing tasks for your patients? ". The comments related to this question were not included in this analysis. Concurrently with the PIRNCA instrument, separate sheets with twenty items regarding demographic data were distributed to the participants concerning variables such as gender, age, educational level or specialisation, as well as information regarding clinical nursing practice, e.g., length of experience and organisational variables, such as the size of the hospital or patient-nurse ratio. Six of the twenty demographic items (gender, unit type, educational level, total job experience, weekly working hours, length of shifts) included on this sheet were taken from Kalisch's MISSCARE Survey (Kalisch & Williams, 2009). The rest of the demographic data was adapted from the literature for the purposes of the study.

Ethical considerations

The study at hand has obtained the approval of the institutional Ethical Committee. The use of the instrument in our research was approved via written permission received from the author of the PIRNCA instrument herself (Dr Terry Jones). Written consent was also obtained from each of the hospitals included. Nurses were informed about the anonymous nature of their responses and the fact that they voluntarily participated in the research in question upon completion of the questionnaire, ensuring their implied consent.

Data analysis

In data analysis, we used two statistical methods to explore the construct validity and reliability of the PIRNCA instrument. The first method utilized was Principal Component Analysis, presented as a standard statistical test when exploring the factor structure of the instrument. The second method was Rasch analysis, which is not very common in nursing science and has not been used in the evaluation of the PIRNCA instrument before. Also, Principal Component Analysis is focused on the structure; more specifically, it explores how the items form the structure of the instrument and its parts. On the contrary, Rasch analysis looks at the individuals who respond and examines how the individual items fit into the whole. Employing both methods does not result in unnecessary repetition, but in the two providing complementary support for each other. Unidimensionality is required for the Rasch analysis – and this can be justified as the items together form a unique concept. However, Principal Component Analysis may suggest dimensions "inside the concept" structure as inspected from the factorial validity point of view. Therefore, Promax was also selected as the rotation method of choice as we assumed the existence of correlations between items (measuring the topic).

The first analysis was performed by using the statistical program IBM SPSS Statistics 25.0 (IBM Corp., Armonk, New York, NY, USA). Data were analysed for pattern and the frequency of missing data at the participant and the item level. Data imputation was not indicated at any point. Missing data ranged from 0.5% to 0.9% demonstrating high acceptability of the PIRNCA instrument.

The characteristics of the sample were reported using descriptive statistics (frequencies, percentages, mean values, SD). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was applied to find out if continuing with further analysis (Principal Component Analysis) was applicable. Principal Component Analysis is a multivariate technique using for identification of underlying factor structure among items (Abdi & Williams, 2010). The PIRNCA instrument was analysed by this technique in conjunction with the Promax Rotation method utilising Eigen Value Criteria. Additionally, we followed the procedures reported in the original study of Jones (2014). Components were formed based on the Eigen Value Criteria > 1. The number of components that we found reasonable to use was five. Before this, analysis answers that were labelled as "not needed" were excluded. Sum variables based on these components were formed. These were obtained by adding up the coded answers and dividing the calculated sum by the number of variables. So the sum variables have the same scale as individual items.

The sum variables' (components) reliability was checked through the calculation of Cronbach's Alpha Coefficients and via their examination through item analysis of the compatibility of single questions within the used scale. Finally, Cronbach´s Alpha was also calculated for the whole scale.

To provide more statistical information about the unique properties of the PIRNCA in terms of item difficulty and item-person correspondence, Rasch analysis was performed with the application of the WINSTEPS 3.92.1 program. Rasch analysis orders persons according to

their ability and orders items according to their difficulty (Bond & Fox, 2015, 11-12). Rating Scale Model was used to analyse the psychometric properties of the PIRNCA instrument in concern to rating scale functionality (whether categories defined by the latent trait measured are distinct and follow expected ordering), internal scale validity (degree of correspondence between actual responses and expected responses), unidimensionality (to evaluate how much the Rasch dimensions explain the data), person-response validity (how many persons from the sample misfit to data based on their expected response patterns), and person-separation reliability (how sensitively the scale separates persons to different groups) . Moreover, rating scale functionality was investigated in terms of the fact if the scale functioned consistently across the range of inspected items (Bond & Fox, 2015, p. 249). Internal scale validity was assessed with item goodness-of-fit statistics using previously recommended values of infit mean squares (MnSq, 0.6-1.4; Linacre & Wright, 1994). Unidimensionality was assessed through the use of principal component analysis of residuals using the criteria that a minimum of 50% of variance present needs to be explained by the first latent variable (Smith, 1994; Raiche, 2005). Person-response validity was investigated with person goodness-of-fit statistics with the application of criteria that accepted infit MnSq values lower than 1.4 logits (Patomella, Tham, & Kottorp, 2006). It was determined that generally, a maximum of 5% of the sample analysed might fail to produce acceptable goodness-of-fit values (Patomella et al., 2006; Kottorp, Bernspång & Fisher 2003). Furthermore, in concern to person-separation reliability, a person-separation index higher than 1.5 was required to demonstrate that the instrument could differentiate respondents with a minimum rating on two different levels (Bond & Fox, 2015, p.135-137).

Prevalence of rationed care

According to the validation study of Jones (2014), there is one method of scoring the PIRNCA instrument. This method advocates using the arithmetic mean score by calculating all items as the overall mean composite score. Likewise, there are different ways to describe the prevalence of rationing by activity, individual and overall. These other ways use a count of dichotomized occurrences for a specific cut off point including a percentage of rationing greater than never, a mean number of rationing of an element greater than never and a mean percentage of rationing elements greater than never. In our study, all of the mentioned methods were used to ensure the comprehensiveness of the results received. In the result section, we presented the overall prevalence of rationed care activities, followed by the prevalence stratified by hospital type. Furthermore, we applied a higher threshold of the frequency of care activities being rationed by RNs and presented care activities that were often rationed by RNs.

Validity, reliability and rigour

The data for this research were collected using the Perceived Implicit Rationing of Nursing Care (PIRNCA) instrument - the Slovak version. In the Slovak Republic, the PIRNCA instrument was translated as a part of a research project conducted by authors (BLINDED FOR

PEER REVIEW) using the method of forward-backwards translation and was further piloted within acute care settings on a study group of 264 registered nurses (BLINDED FOR PEER REVIEW). The psychometric testing of the instrument was previously performed in the national study (BLINDED FOR PEER REVIEW) but only with using one approach. We used a specific sample of registered nurses and two particular methods of testing the multidimensionality of the PIRNCA instrument.

RESULTS

Sample characteristics

The research sample (n=895) consisted of registered nurses (RNs) from 72 care units. Almost all RNs were female (97.9%). All RNs (100 %) worked at university or faculty hospitals that were a public provider, and all of the hospitals had more than 500 beds (100 %). More of the participating RNs worked in faculty hospitals (70.8 %) than university hospitals. Number of patients that these RNs were responsible for caring ranged from 1 patient to 58 (M=13.98, SD=9.35) patients per one shift. The number of RNs responsible for caring for a number of patients was various, and it ranged from 1 nurse to 17 nurses per one shift (M=2.81, SD=3). Sample characteristics are stratified by the hospital type and are fully reported in Table 1.

Construct validity and reliability of the PIRNCA instrument

According to the result of the KMO test of sampling adequacy (0.962), data were appropriate for further Principal Component Analysis. The correlation matrix was considered as being a non-identity matrix, according to Barlett´s test of sphericity (χ^2= 12647.961; p<.001). Results from the Principal Component Analysis are all reported in Table 2. Communalities (ranged from 0.56 to 0.88) and eigenvalues are all reported in Table 3.

Inter-item correlations ranged from 0.512 to 0.683 and supported the use of Pearson´s coefficient that was the basis for Principal Component Analysis. When applying the Principal Component Analysis following the Promax rotation method, five components were identified. Factor loadings were suppressed to < 0.4 because of a better interpretation of the results. All factors have a sufficient number of items that have meaningful loadings (> 0.4), with the exception of item number 26 illustrating the loading slightly under (0.392). Almost all of the items were clearly found to belong to the identified components with the exception of item number 14, which cross-loaded taking place between components two and five. Considering the higher value of factor loading (0.543) as well as the meaning of the item in relation to the components, we added the item number 14 to the component five. Finally, the matrix of rotated factor loadings showed the following pattern: factor 1 (*Assistance with physical care*) consisted of items 1-8, explaining 35.65% of variance; factor 2 (*Monitoring-safety-support*) of items 15-21 and 13, explaining 11.82% of variance; factor 3 (*Documentation-supervision*) of items 26-31, explaining 9.11% of variance; factor 4 (*Communication*) of items 22-25 explaining 7.80% of variance, and factor 5 (*Implementation of the prescribed treatment plan*) of items 9-12 and 14, explaining 7.32% of variance. Five-factor solution explained 71.70 % of the variance. Identified components were labelled similarly as in the original BERNCA instrument (Schubert et al., 2007).

The reliability of the instrument was confirmed by the high values of the Cronbach Alpha, which were reported for each one of the particular components and the whole instrument as well as by values of the item-total correlations (that ranged from 0.55 to 0.83) (Table 3). If any of the items of the instrument were deleted, the reliability of it was not significantly changed.

Based on Rasch analysis, the evaluation of the rating scale functionality of the PIRNCA was demonstrated monotonically in an advancing order with outfit MnSq values less than 2.0 (ranging between 0.98-1.23). Rasch item analysis for the 31-item PIRNCA revealed that only one item (no 13) was slightly over the recommended 1.4 infit MnSq value (1.47, Table 4). All other items had acceptable item goodness-of-fit values in the range between 0.81-1.23. The principal component analysis of the present residuals demonstrated that the first component explained 47.2 % of the total variance within the scale. There is no recommended value; however, the higher values demonstrate the unidimensionality of the scale. The variance explained by the contrast of the present residuals was low 6.1 % (eigenvalue 3.6). When evaluating person-response validity and how well the scale corresponds with persons expected responses, it was found to be in a total of 15 % (n=135) of persons having values that were higher than the recommended infit of 1.4 and 12 % (n=106) of persons having values lower than the infit value of 0.6. The identified person-separation index quantifies the ability of the scale to differentiate between individuals possessing varying levels of the trait where values should be higher than 2, and this is typically treated as an index of reliability. Here the person-separation index was 3.19, and the determined Rasch equivalent Cronbach's Alpha was 0.91.

Prevalence of rationed nursing care across university and faculty hospitals

The identified estimate of the prevalence of rationed nursing care at university and faculty hospitals was 42.1 %. In general, 87.6 % of RNs rationed at least one or more nursing care activities during their last seven working shifts. The mean number of nursing care activities being rationed was determined to be 13.05 per nurse. The identified mean composite score ranged from 1.79 (less than "rarely") to 2.59 (more than "rarely"). The description of nursing care activities rationed is illustrated in Table 3. According to the analysis, the most rationed nursing care activities that were reported were as follows: keeping a patient or family member waiting longer than 5 minutes when a request was initiated (68.0 %), having an important conversation with another member of a patient´s multidisciplinary team regarding his/her care (59.5 %), emotional or psychological support to a patient (or family) (57.0%), reviewing multidisciplinary patient documentation (54.4 %), and monitoring a patient´s affectedness and behaviour (e.g., compliance, eating habits, social interaction, mood) (54.4 %). In contrast, the least rationed nursing care activities that were reported were as follows: administering enteral or parenteral nutrition in accordance with safe practices (19.7 %), administering medications (including intravenous therapy) in accordance with safe medication practices (21.6 %), changing intravenous access sites, tubing, and/or dressings within the timeframe (25.1 %), providing wound care (including changing dressings) (25.5 %), and carrying out routine hygiene for patients (e.g., bathing, oral care, dental care) or ensuring completion of this task through delegation (29.6 %).

We stratified the analysis of the prevalence of rationed care by hospital type (Table 5). The prevalence of rationed care was very similar, specifically at university hospitals, the rate was 42.7%, and at faculty hospitals, it was 41.5%. The mean number of nursing care activities being rationed was determined to be 12.87 per nurse at faculty hospitals, 13.1 at university hospitals. The identified mean composite score ranged from 1.86 (less than "rarely") to 2.62 (more than "rarely") for faculty hospitals from 1.51 (less than "rarely") to 2.24 (more than "rarely") for university hospitals. The prevalence of rationed care in particular hospitals is quite similar comparing to the overall prevalence.

Comparing to the overall results related to the identification of particular activities rationed by RNs, differences were found among hospitals. At university hospitals, two of the most rationed care activities were adhering to recommended guidelines for safe patient handling and providing the amount of teaching for the patient or his/her family (53.3%) which were not typical for faculty hospitals. Furthermore, differences were also found in activities that are rationed the least by RNs. At faculty hospitals, monitoring a patient´s physiologic status, e.g., vital signs, lab values (29.7%) was one of the rationed care activities at least, and at university hospitals, it was carrying out routine skincare for patients or ensuring completion of this task through delegation (27.6%).

Finally, when applying a higher threshold (4- often) of the frequency with which RNs rationed nursing care activities, we identified five of them that should be addressed. These activities were the same for both faculty and university hospitals. The most rationed care activities were reported as follows: keeping a patient or family member waiting longer than 5 minutes when a request was initiated (overall - 8.4%; at faculty hospitals – 9.3%; at university hospitals 6.1%), adhering to recommended guideline for safe patient handling (overall – 7.8%; at faculty hospitals – 7.6%; at university hospitals 8.4%), emotional or psychological support to patient (or family) (overall – 6.3%; at faculty hospitals – 5.5%; at university hospitals 8.0%), documenting all of the nursing care a nurse provided in sufficient detail (overall – 5.3%; at faculty hospitals – 4.6%; at university hospitals 6.9%) and adequately evaluating the plan of care (using critical thinking) to determine the appropriateness and/or effectiveness of interventions and make revisions as indicated (overall – 4.8%; at faculty hospitals – 5.7%; at university hospitals 2.7%). Exploration of the most rationed care activities by application of the higher threshold revealed some important issues that should be addressed further, mainly related to the documentation of nursing care.

DISCUSSION

The findings of our study revealed that the prevalence of rationed nursing care at university and faculty hospitals is at a level of more than 40%. According to studies conducted in other European countries, such as Switzerland (e.g., Schubert et al., 2008; Schubert et al., 2009; Zúñiga et al., 2015), the prevalence of rationed care was reported to be less than 30%. This number indicates that rationed nursing care is an actual and serious problem within selected hospitals in the Slovak Republic. Furthermore, the majority of nurses (87.6%) reported one or more nursing care activities being rationed by them which is consistent with findings of

many American (Jones, 2015; VanFosson et al., 2018) as well as European studies (Schubert et al., 2008; Schubert et al., 2013), indicating that the actual number could be higher, even approaching 100% of all nurses. According to several authors (Jones, 2015; VanFosson et al., 2018), the most rationed activity is an early response to a patient's request or need, a finding also confirmed in our study. Other nursing care activities that are most often rationed by RNs were as follows: providing emotional or psychological support, having an important conversation with team members or the review of documentation by the care team (Dhaini et al., 2017; Jones, 2015; VanFosson et al., 2018). Moreover, Schubert et al. (2013) emphasised that the most frequently rationed nursing activities are related to the provision of care, support, and general documentation. The least rationed nursing care activities are related to administering medication, enteral or parenteral nutrition, providing wound care or changing IV sites or tubes. Very similar findings were reported in American studies (Jones, 2015; VanFosson et al., 2018). However, Schubert et al. (2013) reported the least rationed activities as being continence training or patient education. As a part of our study, we can conclude that the most rationed nursing care activities are the independent ones. However, the least rationed are the dependent nursing care activities resulting from prescriptions made by physicians.

The evaluation of the psychometric properties of the PIRNCA instrument was performed by using two different approaches – Principal Component Analysis and the Rasch analysis. The combination of these methods has not been applied before in any of the studies mentioned above. According to selected studies (Jones, 2014; VanFosson et al., 2018), all 31 items that the PIRNCA instrument consists of can be uploaded to one component as a result of exploratory factor analysis. In our study, utilizing the method of Principal Component Analysis following the Promax rotation has revealed that these items all belonged to the predefined five components very clearly except for item number 14 which was found to have the ability to belong to two components according to the value of the item. We considered that the higher value of the item caused it to be assigned to the selected component as shown in the results of this study. The five components of the PIRNCA instrument were labelled similarly as they were reported in the BERNCA tool. Apparently, only small differences are visible between the PIRNCA instrument and its parent instrument the BERNCA. Reliability of the PIRNCA instrument and its components was confirmed using primarily the Cronbach's alpha coefficient which was also reported as being used in several other studies dedicated to this particular topic (Jones, 2014; Jones, 2015; VanFosson et al., 2018; Zeleníková et al., 2019) and was also found to be consistent with their findings. Based on this analysis, the PIRNCA instrument is a valid and reliable tool, and it can be divided into five components, as was reported in previous studies.

The Rasch analysis partially supported the psychometric properties of the PIRNCA scale. The functionality of the rating scale was found to be acceptable. However, the inspection of how the items actually fit and the unidimensionality of the scale revealed a slight variation in the internal scale validity. One item (no. 13) had a slightly high infit value, due possibly to a redundant wording of the item or irrelevant content in respect to its respondents (Tennant et al. 2007). The unidimensionality of the PIRNCA was a little bit lower (47.2%) than the recommended criteria had indicated (50%) and the first determined variance explained by the first found contrast was identified as being 6.1%, indicating that there might be a degree of multidimensionality present. To overcome this, item wording and unambiguity are both aspects that may be worth inspecting, and an overall revision may be needed in the future. The person

misfit values were over the recommended values indicating idiosyncratic responses. This might be due to the fact that the participants do not consider the content of the instrument to be reasonable for them and are providing responses in the hope of a possible change taking place. The person-separation index was acceptable, indicating that the scale could differentiate for people at a degree of at least three levels of frequency of rationing.

Using different approaches in the exploration of the factor structure and reliability of the instrument revealed very acceptable psychometric properties of the PIRNCA instrument. As this approach has not yet been used in studies using the PIRNCA instrument, we highly recommend its application in further examinations of this measurement tool in differing settings.

Limitations

This study focused only on the specific conditions present in university and faculty hospitals in the Slovak Republic with an emphasis placed on adult acute care settings. Concerning these limitations, the response rate of the study conducted was reasonable, and the sample was well represented in terms of the demographics of age and gender of most average RNs working in the acute care settings in Slovakia. Our evidence is supported by Regulation No. 225/2017 of minimal personal requirements, so our sample of registered nurses reflected an average of nurses working in the units included in our study. On the contrary, there is a need to include more hospitals from the whole area of the Slovak Republic as well as to include different settings to generalise the findings.

CONCLUSION

The phenomenon of rationed care seems to be a serious problem in the Slovak Republic, as revealed in its examination within the specific context of acute care settings of faculty and university hospitals. The measurement of rationed care helps to understand the specific nursing care activities that may lead to missed nursing care which may, in turn, result in having a further severely negative impact on nurse- and patient-related outcomes. Moreover, it is necessary to have a specific, valid and reliable instrument to measure the implicit rationing of nursing care as the results need to be manageable so that specific strategies can be applied by hospital management. The PIRNCA instrument is an accurate and sensitive tool for measuring the phenomenon. Based on the analysis conducted in our study, we suggest that the PIRNCA instrument is a valid and reliable tool with signs of multidimensionality which need to be explored further. Besides, the PIRNCA instrument helps to make particular nursing care activities more visible for hospital management. On the contrary, further studies into the tool are needed to test the PIRNCA in different settings, e.g., long-term settings to demonstrate its stability. Furthermore, we suggest using the instrument in other European countries to see whether there are visible differences in the context of differing cultures. Moreover, it is necessary to emphasise the fact that a nurse's perspective is critical when examining rationed nursing care – and in turn, also a patient's perspective is in need to be properly explored as well.

Conflict of Interest statement

[The Author's declare no conflicts of interest.]

REFERENCES

Bond, T.G., & Fox, C.M. (2015). Applying the Rasch model. Fundamental measurement in the human sciences. 3rd ed. Routledge, New York, NY.

Cho, E., Lee, N.-J., Kim, E.-Y., Kim, S., Lee, K., Park, K.-O., & Sung, Y.H. (2016). Nurse staffing level and overtime associated with patient safety, quality of care, and care left undone in hospitals: A cross-sectional study. *International Journal of Nursing Studies, 60*(2016), 263-271. https://doi.org/10.1016/j.ijnurstu.2016.05.009

Dhaini, S.R., Zúñiga, F., Ausserhofer, D., Simon, M., Kunz, R., De Geest, S., & Schwendimann, R. (2017). Are nursing home care workers' health and presenteeism associated with implicit rationing of care? A cross-sectional multi-site study. *Geriatric Nursing, 38*(1), 33-38. http://dx.doi.org/10.1016/j.gerinurse.2016.07.003

Herlitz, A. (2016). The limited impact of indeterminacy for healthcare rationing: how indeterminacy problems show the need for a hybrid theory, but nothing more. *Journal of Medical Ethics, 42*(1), 22-25. https://doi.org/10.1136/medethics-2015-102937

Jones, T.L. (2014). Validation of the Perceived Implicit Rationing of Nursing Care (PIRNCA) Instrument. *Nursing Forum, 49*(2), 77–87. https://doi.org/10.1111/nuf.12076

Jones, T.L. (2015). A descriptive analysis of implicit rationing of nursing care: Frequency and patterns in Texas. *Nursing Economics, 33*(3), 144–54.

Jones, T. L., Gemeinhardt, G., Thompson, J. A., & Hamilton, P. (2016). Measuring unfinished nursing care: What to consider when choosing and scoring surveys. *Journal of Nursing Care Quality, 31*(1), 90-97. https://doi.org/10.1097/NCQ.0000000000000143

Kalisch, B.J., & Williams, R.A. (2009). Development and psychometric testing of a tool to measure missed nursing care. *Journal of Nursing Administration, 39*(5), 211–219. https://doi.org/10.1097/NNA.0b013e3181a23cf5

Kottorp, A., Bernspång, B., & Fisher, A.G. (2003). Validity of a performance assessment of activities of daily living for people with developmental disabilities. *Journal of Intellectual Disability Research,47*(Pt 8), 597–605.

Linacre, J.M., & Wright, B.D. (1994). Reasonable mean-square fit values. *Rasch Measurement Transactions,8*(3), 370.

Patomella, A.H., Tham, K., & Kottorp, A. (2005). P-drive: assessment of driving performance after stroke. *Journal of Rehabilitation Medicine, 38*(5), 273–279. https://doi.org/10.1080/16501970600632594

Papastavrou, E., Andreou, P., & Efstathiou, G. (2014). Rationing of nursing care and nurse-patient outcomes: a systematic review of quantitative studies. *International Journal of Health Planning and Management,29*(1), 3–25. https://doi.org/10.1002/hpm.2160

Raiche, G. (2005). Critical eigenvalue sizes in standardized residual principal component analysis. *Rasch Measurement Transactions,*19:1012.

Rochefort, C.M., & Clarke, S.P. (2010). Nurses' work environments, care rationing, job outcomes, and quality of care on neonatal units. *Journal of Advanced Nursing, 66*(10), 2213–2224. https://doi.org/10.1111/j.1365-2648.2010.05376.x

Rochefort, C.M., Ratwell, B.A., & Clarke, S.P. (2016). Rationing of nursing care interventions and its association with nurse-reported outcomes in the neonatal intensive care unit: a cross-sectional survey. *BMC Nursing, 2016*(15):46. https://doi.org/10.1186/s12912-016-0169-z

Schubert, M., Glass, T.R., Clarke, S.P., Schaffert-Witvliet, B., & De Geest, S. (2007). Validation of the Basel extent of rationing of nursing care instrument. *Nursing Research, 56*(6), 416–24. https://doi.org/10.1097/01.NNR.0000299853.52429.62

Schubert, M., Clarke, S.P., Aiken, L.H., & De Geest S. (2012). Associations between rationing of nursing care and inpatient mortality in Swiss hospitals. *International Journal for Quality in Health Care, 24*(3), 230–238. https://doi.org/10.1093/intqhc/mzs009

Schubert, M., Glass, T.R., Clarke, S.P., Aiken, L.H., Schaffert-Witvliet, B., Sloane, D.M., & De Geest, S. (2008). Rationing of nursing care and its relationship to patient outcomes: the Swiss extension of the International Hospital Outcomes Study. *International Journal for Quality in Health Care, 20*(4), 227–237. https://doi.org/10.1093/intqhc/mzn017

Schubert, M., Clarke, S.P., Glass, T.R., Schaffert-Witvliet, B., & De Geest, S. (2009). Identifying thresholds for relationships between impacts of rationing of nursing care and nurse- and patient-reported outcomes in Swiss hospitals: a correlational study. *International Journal of Nursing Studies, 46*(7), 884–893. https://doi.org/10.1016/j.ijnurstu.2008.10.008

Schubert, M., Ausserhofer, D., Desmedt, M., Schwendimann, R., Lesaffre, E., Li, B., & De Geest, S. (2013). Levels and correlated of implicit rationing of nursing care in Swiss acute care hospitals – a cross-sectional study. *International Journal of Nursing Studies, 50*(2), 230-239. https://doi.org/10.1016/j.ijnurstu.2012.09.016

Smith, R.M., & Miao, C.Y. (1994). Assessing unidimensionality for Rasch measurement. In: Wilson, M., editor. Objective measurement: Theory into practice. Greenwich: Ablex; 1994.

Strech, D., & Danis, M. (2014). How can bedside rationing be justified despite coexisting inefficiency? The need for 'benchmarks of efficiency'. *Journal of Medical Ethics, 40*(2), 89-93. https://doi.org/10.1136/medethics-2012-100769

Scott, A.P., Harvey, C., Felzmann, H., Suhonen, R., Habermann, M., Halvorsen, K., Christiansen, K., Toffoli, L., & Papastavrou, E. (2018). Resource allocation and rationing in nursing care: a discussion paper. *Nursing Ethics.* https://doi.org/10.1177/0969733018759831

Suhonen, R., Stolt, M., Habermann, M., Hjatadottir, I., Vryonides, S., Tonnessen, S., Halvorsen, K., Harvey, C., Toffoli, L., & Scott, P.A. (2018). Ethical elements in priority setting in nursing care: a scoping review. *International Journal of Nursing Studies, 88*(2018), 25-42. https://doi.org/10.1016/j.ijnurstu.2018.08.006

Tennant, A., Conaghan, P.G. (2007). The Rasch measurement model in rheumatology: what is it and why use it? When should it be applied, and what should one look for in a Rasch paper? *Arthritis and Rheumatism, 57*(8), 1358-1362. https://doi.org/10.1002/art.23108

VanFosson, C.A., Jones, T.L., & Yoder, L.H. (2018). Monthly variation of unfinished nursing care at the US Army Burn Center. *Burns, 44*(8), 1910-1919. https://doi.org/10.1016/j.burns.2018.03.008

Williams, R.G.A. (1980). Rationing: how it is done with community services for the older disabled. *International Rehabilitation Medicine, 2*(4),160-166.

Zeleníková, R., Gurková, E., Friganovic, A., Uchmanowicz, I., Jarošová, D., Žiaková, K., Plevová, I., Papastvarou, E. (2019). Unfinished nursing care in four central European countries. *Journal of Nursing Management*, *2019*;00:1-13. https://doi.org/10.1111/jonm.12896

Zúñiga, F., Ausserhofer, D., Hamers, J.P.H., Engberg, S., Simon, M., & Schwendimann, R. (2015). The relationship of staffing and work environment with implicit rationing of nursing care in Swiss nursing homes – A cross-sectional study. *International Journal of Nursing Studies, 52*(9),1463-1474. https://doi.org/10.1016/j.ijnurstu.2015.05.005

Zúñiga, F., Schubert, M., Hamers, J.P.H., Simon, M., Schwendimann, R., Engberg, S., & Ausserhofer, D. (2016). Evidence on the validity and reliability of the German, French and Italian nursing home version of the Basel Extent of Rationing of Nursing Care instrument. *Journal of Advanced Nursing,72*(8), 1948-1963. https://doi.org/10.1111/jan.12975

Table 1. Sample characteristics (n=895)

Variable				Faculty hospitals		University hospitals	
		N=895	%	N=634	%	N=261	%
Nurse Age	20 – 30 years 31 – 40 years 41 – 50 years 51 – 60 years More than 60 years **M±SD (range)** 43±9.9 (20-67)	128 208 363 184 12	14.3% 23.2% 40.6% 20.6% 1.3%	81 126 273 148 6	12.8% 19.9% 43.1% 23.3% 0.9%	47 82 90 36 6	18.0% 31.4% 34.5% 13.8% 2.3%
Nurse Experience in current unit (years)	Up to 5 years 6 – 10 years 11 – 15 years 16 – 20 years More than 21 years **M±SD (range)** 12.5±2.1 (1-45)	257 183 103 99 253	28.7% 20.5% 11.5% 11.1% 28.2%	180 122 68 72 192	28.4% 19.2% 10.7% 11.4% 30.3%	77 61 35 27 61	29.5% 23.4% 13.4% 10.3% 23.4%
Nurse Experience in nursing (years)	Up to 5 years 6 – 10 years 11 – 15 years 16 – 20 years More than 21 years **M±SD (range)** 17±3.9 (1-49)	128 86 86 118 477	14.3% 9.6% 9.6% 13.2% 53.3%	96 56 56 85 339	15.1% 8.8% 8.8% 13.4% 53.9%	32 28 30 33 138	12.3% 10.7% 11.5% 12.6% 52.9%
Variable		**N = 895**	**%**	**N=895**	**%**	**N=895**	**%**
Unit type	Surgical Medical Elderly care ICU other	278 281 28 279 29	31.1% 31.3% 3.1% 31.2% 3.3%	211 191 28 175 29	33.2% 30.2% 4.4% 27.6% 4.6%	67 90 0 104 0	25.7% 34.5% 0.0% 39.8% 0.0%
Nurse Education Level	Secondary education Higher education Bachelor degree Master degree or higher	221 242 200 232	24.7% 27.1% 22.2% 26.0%	159 168 143 164	25.1% 26.5% 22.5% 25.9%	62 74 57 68	23.7% 28.4% 21.8% 26.1%

Nurse Specialization training programme	Yes No	600 295	67.1% 34.9%	422 212	66.6% 33.4%	178 83	68.2% 31.8%
Work commitment	Full time Part-time employment	882 13	98.5% 1.5%	632 2	99.4% 0.6%	250 11	95.8% 4.2%
Working hours per week	Less than 30 hours More than 30 hours	43 852	4.8% 95.2%	27 607	4.3% 95.7%	16 245	6.1% 93.9%
Work pattern	Days Evenings/Nights Rotates	254 38 603	28.4% 4.2% 67.4%	187 30 417	29.5% 4.7% 65.8%	67 8 186	25.7% 3.0% 71.3%
Shifts	8 or 10-hour shifts 12-hour shifts Changing 8 and 12-hour shifts	184 630 81	20.6% 70.4% 9.0%	148 431 55	23.3% 68.0% 8.7%	36 199 26	13.8% 76.2% 10.0%
Overtime hours*	None Less than 12 hours More than 12 hours	254 225 416	28.4% 25.1% 46.5%	188 157 289	29.7% 24.8% 45.5%	66 68 127	25.3% 26.1% 48.6%
Missed work due to illness or injury*	None 1 shift 2-3 shifts More than 4 shifts	614 124 86 71	68.6% 13.8% 9.6% 8.0%	439 88 59 48	69.2% 13.9% 9.3% 7.6%	175 36 27 23	67.0% 13.8% 10.3% 8.8%
Intention to leave the position	In the next 6 months In the next year No plans to leave	43 110 742	4.8% 12.3% 82.9%	30 85 514	4.7% 13.4% 81.9%	13 25 223	4.9% 9.6% 85.5%
Intention to leave the workplace	No plans to leave Neither yes, neither no Plans to leave	471 340 84	52.7% 38.0% 9.4%	329 248 57	51.9% 39.1% 9.0%	142 92 27	54.4% 35.2% 10.4%
Intention to leave the profession	No plans to leave Neither yes, neither no Plans to leave	597 255 43	66.7% 28.5% 4.8%	416 188 30	65.6% 29.7% 4.7%	181 67 13	69.4% 25.7% 4.9%
Staffing adequacy	100% of the time 75% of the time 50% of the time 25% of the time 0% of the time	73 309 301 166 46	8.2% 34.6% 33.6% 18.5% 5.1%	51 216 203 130 34	8.0% 34.1% 32.0% 20.5% 5.4%	22 93 98 36 12	8.4% 35.6% 37.5% 13.8% 4.7%

*in past three months

Table 2 Principal Component Analysis (rotated components)*

Items	Rotated Component Loadings				
	1	**2**	**3**	**4**	**5**
PIRNCA 6	,833	,122	-,097	,006	-,010
PIRNCA 1	,797	-,262	,387	-,077	-,023
PIRNCA 5	,780	,294	-,011	-,062	-,116
PIRNCA 4	,779	,241	-,212	,050	,013
PIRNCA 3	,774	-,022	-,049	,150	,010
PIRNCA 2	,750	-,219	,257	-,042	,157
PIRNCA 7	,677	,068	,037	,065	,046
PIRNCA 8	,576	,126	-,134	,139	,192
PIRNCA 18	,078	,858	,085	-,340	,078
PIRNCA 19	-,008	,778	,072	,109	-,082
PIRNCA 17	,040	,771	-,008	,175	-,172
PIRNCA 13	,013	,665	-,004	,131	-,012
PIRNCA 16	,090	,641	,102	-,183	,200
PIRNCA 20	,105	,630	,115	,032	,073
PIRNCA 15	-,045	,544	-,017	,296	,072
PIRNCA 21	,073	,361	,106	,224	,118
PIRNCA 30	,046	,161	,906	-,105	-,082
PIRNCA 31	,079	,103	,859	-,052	-,053
PIRNCA 29	,021	,066	,818	-,007	,072
PIRNCA 28	-,107	-,060	,807	,184	,090
PIRNCA 27	-,062	,287	,414	,387	-,114
PIRNCA 26	-,055	,196	,392	,385	,008
PIRNCA 24	,014	-,235	,079	,938	,044
PIRNCA 23	,092	,028	,040	,824	-,042
PIRNCA 22	,030	,142	-,206	,820	,017
PIRNCA 25	,076	,010	,217	,573	,040
PIRNCA 10	,031	-,018	,001	-,053	,957
PIRNCA 9	,034	,018	-,059	,002	,907
PIRNCA 11	,117	-,022	-,069	,106	,792
PIRNCA 12	,100	-035	,116	,012	,743
PIRNCA 14	-,213	,436	,067	,022	,543

*Rotation method: Promax with Kaiser Normalization; rotation converged in 8 iterations

Table 3 Characteristics of the PIRNCA instrument

Nursing care activities*		**% of rationing greater than never**	**Mean**	**SD**	**Item-Total Correlation****	**Communalities**	**Eigenvalues**	**Cronbach´salpha**
Assistance with physical care		***38.4 %***	***1.60***	***0.62***			***16.941***	***0.92***
6	Timely assistance with bowel or bladder elimination	41.4 %	1.65	0.79	0.75	.733		
1	Routine hygiene	29.6 %	1.51	0.80	0.70	.716		
5	Mobilization or changing patient position	44.3 %	1.69	0.81	0.77	.755		
4	Assistance with needed ambulation	43.5 %	1.67	0.80	0.76	.755		
3	Changing soiled bed linen	45.1 %	1.74	0.86	0.75	.691		
2	Routine skin care	30.2 %	1.47	0.72	0.76	.768		
7	Assistance with the intake of food or fluids	35.0 %	1.57	0.78	0.74	.675		
8	Promotion of physical comfort	37.9 %	1.57	0.76	0.71	.672		
Monitoring-safety-support		***45.5 %***	***1.72***	***0.64***			***2.113***	***0.89***
18	Monitoring of the patient´s physiological status	30.1 %	1.46	0.72	0.66	.661		
19	Monitoring of the patient’s affect and behavior	54.4 %	1.90	0.88	0.77	.726		
17	Emotional or psychological support	57.0 %	2.00	0.92	0.70	.680		
13	Adherence to recommended guidelines for safe patient handling	48.1 %	1.89	0.97	0.60	.575		
16	Preparing patients for treatments, tests, or procedures	30.8 %	1.44	0.68	0.66	.633		
20	Monitoring of the patient´s physical safety	43.2 %	1.69	0.83	0.77	.734		

15	Providing the amount of teaching for the patient or his/her family	50.7 %	1.79	0.85	0.66	.612		
21	Following-up on patient status changes	49.4 %	1.73	0.80	0.64	.568		
Documentation-supervision		***48.3 %***	***1.75***	***0.71***			***1.260***	***0.92***
30	Documentation of all of the nursing care provided	47.0 %	1.74	0.88	0.83	.864		
31	Evaluation of the plan of care	49.0 %	1.78	0.86	0.80	.833		
29	Documentation of assessments and monitoring activities	45.4 %	1.69	0.82	0.83	.838		
28	Documentation of the initiation or revision of plan of care	43.7 %	1.67	0.81	0.79	.786		
27	Reviewing the multidisciplinary patient documentation	54.4 %	1.89	0.87	0.71	.723		
26	Provide adequate supervision of or follow-up on delegated activities	50.5 %	1.79	0.82	0.65	.685		
Communication		***54.4 %***	***1.94***	***0.72***			***1.177***	***0.85***
24	Important conversation with an external agency	44.3 %	1.93	0.90	0.69	.759		
23	Important conversation with team members	59.5 %	2.02	0.87	0.79	.818		
22	Timely response to request/need in less than 5 minutes	68.0 %	2.16	0.92	0.65	.683		
25	Important conversation with a patient or family member about discharge	45.6 %	1.75	0.85	0.66	.663		
Implementation of the prescribed treatment plan		***24.7 %***	***1.36***	***0.52***			***.999***	***0.88***
10	Administer enteral or parenteral nutrition	19.7 %	1.30	0.61	0.81	.887		
9	Administer medications	21.6 %	1.32	0.63	0.75	.827		
11	Provide wound care	25.5 %	1.36	0.63	0.77	.778		

12	Change intravenous access sites, tubing, and/or dressings	25.1 %	1.36	0.62	0.75	.761		
14	Adhere to infection control guidelines	31.3 %	1.45	0.69	0.55	.629		
The PIRNCA instrument								***0.96***

*Abbreviated items of the PIRNCA instrument (the instrument cannot be used or reproduced without the written permission of Dr. T. Jones); ** item-total correlations are reported for the components

Table 4 Item fit statistics

			Infit	
Item number	**Measure**	**SE**	**MnSq**	**Z - value**
13	-0.64	0.06	1.47	7.80
3	-0.26	0.06	1.08	1.40
1	0.40	0.07	1.29	4.40
22	-1.26	0.05	1.22	4.20
24	-0.64	0.06	1.23	3.70
6	0.06	0.06	1.02	0.30
17	-0.90	0.06	1.12	2.30
9	1.19	0.08	1.10	1.50
14	0.64	0.07	1.08	1.30
7	0.29	0.06	1.07	1.20
4	-0.04	0.06	0.96	-0.70
18	0.62	0.07	1.05	0.90
25	-0.25	0.06	0.99	-0.20
10	1.30	0.08	1.03	0.50
15	-0.39	0.06	1.02	0.40
30	-0.24	0.06	1.01	0.30
2	0.60	0.07	1.00	0.00
27	-0.63	0.06	0.99	-0.20
21	-0.22	0.06	0.92	-1.50
8	0.25	0.06	0.97	-0.50
28	-0.04	0.06	0.97	-0.50
31	-0.35	0.06	0.95	-0.90
16	0.70	0.07	0.94	-0.90
23	-0.93	0.06	0.91	-1.80
5	-0.10	0.06	0.93	-1.20
11	1.02	0.07	0.90	-1.50
19	-0.64	0.06	0.89	-2.20
12	1.05	0.07	0.88	-1.90
29	-0.10	0.06	0.88	-2.30
26	-0.35	0.06	0.83	-3.40
20	-0.12	0.06	0.81	-3.80

Table 5 Prevalence of rationed nursing care stratified by hospital type

	Faculty hospitals (N=634 RNs)	**University hospitals (N=261 RNs)**
The most rationed care activities	Keeping a patient or family member waiting longer than 5 minutes when a request was initiated (67.1%)	Keeping a patient or family member waiting longer than 5 minutes when a request was initiated (70.5%)
	Having an important conversation with another member of a patient's multidisciplinary team regarding his/her care (59.6%)	Emotional or psychological support to a patient(or family) (61.3%)
	Monitoring a patient's affect and behavior (e.g. compliance, eating habits, social interaction, mood) (55.5%)	Reviewing multidisciplinary patient documentation (59.8%)
	Emotional or psychological support to a patient(or family) (55.4%)	Having an important conversation with another member of a patient's multidisciplinary team regarding his/her care (59.4%)
	Reviewing multidisciplinary patient documentation to inform yourself about a patient (52.1%)	Adhering to recommended guidelines for safe patient handling / provide the amount of teaching for the patient or his/her family (53.3%)
The least rationed care activities	Administering enteral or parenteral nutrition (19.7%)	Administering enteral or parenteral nutrition (19.9%)
	Administering medications including intravenous therapy (21.8%)	Administering medications including intravenous therapy (21.5%)
	Providing wound care including changing dressings (24.8%)	Changing intravenous access sites, tubing, and/or dressings (25.7%)
	Changing intravenous access sites, tubing, and/or dressings (24.9%)	Carrying out routine hygiene for patients (e.g. bathing, oral care, dental care) or ensuring completion of this task through delegation (26.4%)
	Monitoring a patient's physiologic status (e.g. vital signs, lab values) (29.7%)	Carrying out routine skin care for patients or ensuring completion of this task through delegation (27.6%)