Measuring Quality of Care: A Rasch Validity Analysis of Good Nursing Care Scale

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INTRODUCTION

Nursing care quality has changed dramatically since the early 1990s. Due to its multifaceted nature, measurement of nursing care quality is complex[1]. Quality in health care has been studied extensively, and there are also several instruments developed for the evaluation of quality. In a recent systematic reviews[1,2] 11 instruments evaluating the perceptions and experiences of patients in health care were found; most of them seemed to be valid and reliable. In these instruments, there was variation in terms of theoretical background, quality criteria, purpose and use. Based on that, the authors concluded that no single instrument is sufficient; their use depends on the purposes of the study or developmental work.

A lack of consensus in the definition of the quality of nursing care poses problems for evaluation and measurement. For many years, there have been different definitions from different perspectives.[3-5] The widely accepted framework of Donabedian[3] divides the categories of quality into structure, process, and outcome; this is the basis for many later definitions.[4] Furthermore, the division of perspectives into those of patients (clients), nurses (professionals) and the organization has been used,[4] as has listing different quality criteria without any systematic background. These include criteria such as safety, effectiveness, patient-centeredness, timeliness, efficiency, equity, nurse competence and performance, and good leadership.[4,5]

From patients' perspective, it is essential to participate in the evaluation of care and services[6] and to become more empowered through participation.[7] Patients generally evaluate the quality of nursing as high.[8] A distinction between evaluation of patients' level of satisfaction and care experience is needed. Satisfaction is mostly seen as the main quality criterion and it has been

used in many studies and instruments;[9,10] it has evidently been shown to be connected with many organizational factors, such as nurse staffing, work satisfaction, environment and shorter hospital stays.[11,12] The care experience of patients, on the other hand, emphasizes the patients' description of good nursing care and quality nursing care[13,14] and factors connected with quality.[15] In this article, quality is defined with the concept of good nursing care,[13,16] based on descriptions of patients and nurses[13] and in connection with an action theory of nursing.[17] This definition consists of actor (nurse), action (activities), preconditions, environment, proceeding of the process and patient's (client's) own management strategies.

Nurse, the largest healthcare workforce, have a vital part in assuring the quality of care in health care.[18] It has been demonstrated that safety and quality of nursing are related to nurse workforce level.[10,11] Nurses' evaluations of the quality of nursing are mainly high,[19] and they can be seen as independent evaluations, or as an adding to patients' evaluations. Already in the 1990s, Lynn and Moore[20] and later other researchers[19,21] emphasized the combination of evaluations by both providers and patients.

In this article, we report - by using Rasch analysis/modeling - the psychometrics of the Good Nursing Care-Scale (GNCS) which was originally created the in 1990s for the use of hospital patients and nurses.[13,22] Validity and reliability of the GNCS is limited and tested previously with classical test theory framework.[23,24] Methods of modern test theory (i.e., Rasch models) could provide more in-depth analysis and outcomes of such scales. A more in-depth analysis of the GNCS modeling is still lacking. A Rasch analysis can therefore be useful to evaluate and potentially confirm whether the items of the GNCS measure a unidimensional construct.[25]

The aim of the study was to analyze, using Rasch analysis, the psychometric properties of the Good Nursing Care-Scale (addressing rating scale functioning, internal scale validity, person-response validity, person-separation and internal consistency) in a sample of surgical patients and nurses. The ultimate goal was to improve the psychometrical properties of the GNCS to produce more precise and valid estimates of the quality of nursing care. With the shorter version, our aim is to offer an instrument that is useful in connection with other instruments in descriptive and/or experimental designs using a patient-centered approach.

METHODS

Design

An explorative cross-sectional study design was employed.

Sample

Surgical patients (n=480) and nurses (n= 167) at 1 (out of 5) university hospital in Finland participated the study. Both patients and nurses were decided to include the study to provide wide perspective to instrument testing. The patients were from the main areas of surgical care (digestive, eye and ear, gynecological, heart and thorax, orthopedic, urology) and they were included if they were over 16 years old, able to administer the instrument independently, able to understand Finnish or Swedish language (Finland is bilingual country) and participated voluntarily.[26] Convenience sampling was applied. Ethical approval for the study was from the Ethics Committee of the University of Turku (02/2013).

Data collection

The data were collected during 12 weeks (February-May) in 2013 from surgical patients and nurses. The patients responded to the instrument at the end of their hospital period (the day of discharge or the evening before) and returned the questionnaire to a box in the unit. Nurses were from the same wards/units as the patients and their data were collected after collection of the patient data to avoiding contamination. All nurses were given the opportunity to respond; no matching of nurse-patient was possible due to distribution of work in the units.

Instrument

The Good Nursing Care Scale (GNCS) measures the quality of nursing care, originally from the perspective of hospitalized surgical patients.[13,27,28] The GNCS has 2 parallel parts, one for patients and the other for nurses. Both parts consist theoretically of 7 quality categories A: Characteristics of actors, B: Nursing actions, C: Preconditions for care, D: Environment, E: Proceeding of the process, F: Patient management strategies, G: Collaboration with family members/significant others. The response scale is a 4-point scale ranging from “fully agree” (4) to “fully disagree” (1); the option ”no opinion” (0) is also given. Average total scores of 1.0–1.5 indicate very low quality of care, 1.6–2.0 low, 2.1–2.5 fairly low, 2.6–3.0 fairly high, 3.1–3.5 high, and 3.6-4.0 very high quality of care.[26]

The GNCS is based on a grounded theory using descriptions of patients and nurses[13] and is connected with action theory.[17] Over the years, the GNCS has been tested several times and shortened/revised from original 116 items within the limits of the theoretical framework to 40 items[28] which is under investigation in this study (see Supplemental Digital Content, Table 1).

GNCS has earlier been used in hospital contexts[22,29] and it has been modified for pediatric evaluation,[30] midwifery,[31] radiographics[23] and perioperative care[22] and it has been officially translated into English and Swedish,[24] Estonian,[31] Turkish,[32] Lithuanian,[33] and Chinese.[29]

The patients' background factors were demographics (age, gender), living conditions (alone, cohabiting), type of hospital admission (emergency, elective), length of hospital stay, the reason for hospitalization (medical investigation, surgical operation, medication and/or infusion, counseling, other), chronic disease (yes, no), and current state of health (compared to normal state of health, scale 1–4).[26] The nurses' background factors consisted of demographic factors (age, education, length of working experience), work-related factors (nature of position, motivation to work), statistics of the unit and quality-related factors (evaluation of the level of quality as a whole, scale 4–10).

Data analysis

The data were analyzed statistically using Rasch analysis (Winsteps Rasch analysis software, version 3.63.0). The analysis was performed first on category level and the in total-level combining all quality categories of the GNCS. A Rasch model application using a Partial Credit Model[34] was applied.

Evidence of internal scale validity was evaluated using the item goodness-of-fit statistics where the criterion was set for infit to MnSq values between 0.7 and 1.4 logits.[35] Furthermore, the unidimensionality of the Good Nursing Care Scale was additionally evaluated using a principal component analysis of the residuals.[25] The total variance explained by the first latent variable should therefore be at least 50% to fulfill the criterion of unidimensionality.[36] Person-

response validity was assessed using the person goodness-of-fit statistics. The reference values for acceptable person goodness-of-fit were infit MnSq values < 1.4 logits associated with a z-value of < 2.0.[37] Moreover, it is agreed that up to 5% of the sample could demonstrate misfit without being a serious threat to validity.[37] The person-separation reliability index was finally used to evaluate the precision of the estimated values. The person-separation reliability index indicates how the items separate relevant persons by their pattern of scores.[25] An index of >1.5 was presumed to see if the GNCS would separate respondents with minimum of two different quality of care levels.[38]

RESULTS

The patient sample (n=480) consisted of surgical patients with the average age of 59 years (SD 17); a slight majority were males (n=277, 58%). Their educational level was mainly vocational education (49%) or comprehensive school (35%). More than half of them (53%) were retired. The average length of hospital stay was 4.4 days (SD 4.2), and they (78%) had a surgical procedure or operation. At the moment of responding, they estimated their overall health status as good (42%) or fairly good (47%) compared with their normal health status.

The nurse sample (n=167) consisted of 140 registered nurses, 19 licensed practical nurses and 6 nurses with master's degree (2 missing data). They were fairly experienced in health care (mean length of working experience 15.4 years, SD 10.6, range 2 months–44 years) and also in their current unit (mean 8.8 years, SD 8.3, range 1 month–39 years). Most of them (n=121, 73%) had a permanent position, were motivated in their work (n=117, 70%) and evaluated the total level of the quality in their unit as high (mean 8.3, SD 0.9, range 5–10).

Rasch analysis of each of the quality categories of the GNCS

Patient data

A Rasch analysis was initially performed on all 7 (A-G) quality categories of the GNCS with both patient and nurse data (see Supplemental Digital Content, Table 2). Internal scale validity in patient data varied highly between different quality categories. Acceptable item fit statistics were present in 3 quality categories (C: Precondition for care, E: Proceeding of the process and F: Patient management strategies). In the remaining 4 quality categories there was 1 item in each demonstrating item misfit (A21: 1.71 logits, B23: 1.49 logits, D37: 1.68 logits, G51: 1.41 logits).

Dimensionality ranged between 32.0 (D: Environment) and 77.7% (G: Collaboration with family members/significant others), being above the recommended 50% in three quality categories (C: Preconditions for care 61.2%, F: Patients' management strategies 65.7%, G: Collaboration with family members/significant others 77.7%). In person response validity, the percentage of the sample to demonstrate acceptable goodness-of-fit statistics ranged from 3% to 8% in the quality categories, a slight majority of the quality categories (n=4) being above the recommended criterion, 5%. Person separation indexes were low in most of the quality categories. Only 1 quality category, G: Collaboration with family members/significant others, had acceptable separation index (1.68) indicating that this was the only category that could differentiate respondents into at least 2 groups.

Nurse data

In nurse data, the internal scale validity evaluated with item goodness-of-fit statistics revealed that only 2 quality categories had acceptable item fit statistics (B: Nursing actions, E: Proceeding of the process). In total 3 quality categories had one misfitting item (E38: 1.47 logits, F48: 1.56 logits, G54: 1.44 logits) while 2 quality categories had 2 misfitting items (A18: 1.52 logits, A21: 1.71 logits; C29: 1.42 logits, C32: 1.63 logits, see Supplemental Digital Content, Table 2).

Dimensionality varied from 36.0% to 70.0%. In 2 quality categories, dimensionality remained lower than recommended 50% value, namely B: Nursing actions 37.8% and D: Environment 36.0%. Person misfit was evident across all categories. Percentage of misfit ranged from 3% to 15%. Only 1 quality category (B: Nursing actions) had acceptable person goodness-of-fit statistics (3% of the sample demonstrated unsuitable goodness-of-fit by chance). Person separation indexes ranged between 0.63 and 1.64. Only 1 quality category (G: Collaboration with family members/significant others) had acceptable person-separation reliability. The other 6 quality categories remained below the recommended value of 1.5 logits.

Joint Rasch analysis combining all of the quality categories of the GNCS

Patient data

Based on analysis of item goodness-of-fit statistics for the joint 40-item GNCS revealed that 7 items were misfitting to the Rasch model. In total 5 items (items A21, D35, D36, D37, E39) had high infit values (range 1.41–2.24) and 2 had very low infit values (A19 infit 0.62 and B22 infit 0.56).

The principal component analysis of the residuals in patient data still revealed that 64.4% of the total variance in the GNCS was explained by the 1st component. This explained variance was above the recommended criteria of the 50% (see Supplemental Digital Content, Table 3). Investigation of item hierarchy of the GNCS in patient data revealed that item A17 (Kindness) was the item most commonly agreed upon by the sample and item G55 (Encouragement) the least likely to agree upon for the subjects. Regarding person-response validity, 59 respondents (12%) did not demonstrate acceptable goodness-of-fit with the Rasch model. The person separation index was 2.04, indicating that the sample could be divided into at least 3 quality groups, and the Rasch equivalent Cronbach's alpha was 0.81.

Nurse data

In nurses' data, the item goodness-of-fit statistics demonstrated that 7 items were misfitting. In total 5 items (C32, D36, F48, G54, G55) had high misfit values (range 1.41-2.54) and 2 items (A19, E39) demonstrated lower values (0.69, 0.61). The unidimensionality was still supported as the first component explained 58.9% of the total variance. The item hierarchy indicated that items A17 (Kindness) and B23 (Professional skills) were the most likely to agree while item E39 (Collaboration with unit) was the least likely to agree. Person-response validity indicated that 16% (n=26) of the sample was misfitting to the Rasch model as having infit MnSq higher than 1.4 logits. The person separation index was 2.71 with the Rasch equivalent Cronbach's alpha 0.88.

DISCUSSION

In this article, we report the psychometrics of the Good Nursing Care-scale by using Rasch analysis. To our knowledge, this is the first study where psychometric properties of GNCS are evaluated with Rasch analysis in a sample of both adult surgical patients and nurses, even though the psychometrics of the scale has been tested in previous studies. In this version, we used the shortened version with 40 items, and the findings of this study indicate that GNCS is a unidimensional and psychometrically sound instrument. The explained variance of the latent variable in the GNCS was above the criterion of 50% for both the patient and nurse data and the proportion of variance explained by the second dimension remained low (less than 5%).

In nurse data, there were 7 misfitting items. The reason for this might be the response patterns of the respondents. The items with high misfitting values had a biased response pattern as the majority of respondents had used only response options 3 or 4 (range 76–97%). In contrast, in items with low misfitting values the majority of respondents had mainly used the options 2 and 3. In addition, in these misfitting items the number of responses per each category was also lower than the criterion of 10 responses. There were also some misfitting items in patient data. The response pattern in these items was biased because the respondents had mainly used (84-97%) response options 3 or 4 instead of using all options on the 4-point response scale. Out of 7 misfitting items, 3 were the same as in the nurse data (items A19, D36, E39). The inclusion of items with poor fit can decrease the precision of the measure leading to erroneous conclusions in quality evaluations.[25] However, the item misfit in nurses' data was relatively low as all misfitting values were less than 2.54 logits.

Person misfit was higher than the expected 5% in both samples. When investigating high person misfit values (above 1.4 logits), 16% of the respondents in the nurse data and 12% in the patient data did not demonstrate acceptable goodness-of-fit. This might indicate that

person performances are not close enough to the Rasch model's requirements; this may be due to idiosyncratic responses to items. Fit at the item level can be influenced by respondents with high positive residuals.[39] Atypical response patterns of this kind may be related to patients' background (e.g. comorbidity or cognitive status) or item wording (e.g. ambiguous wording). On the contrary, persons with low infit values have some redundancy in the responses, but they do no harm to the Rasch model.[40] However, external construct validity of the GNSC should be investigated further in this patient group, e.g. revision of misfitting items (changes in wording or removing misfitting items). Person separation was acceptable, indicating that the GNCS is sensitive to separate between high and low responders.[39]

The Rasch analysis supports the reliability of GNCS. The Rasch equivalent Cronbach's alpha values were high (0.81 for patient data and 0.88 for nurse data). This is in line with previous studies[26,27] where GNSC reliability has been investigated using Cronbach's alpha coefficient. When investigating the 7 GNCS quality categories the results were parallel to the findings when evaluating GNCS as a whole. In both samples, dimensionality varied on quality category level, but unidimensionality was achieved when investigating dimensionality on total scale level.

In future, the GNCS could benefit from revision by reducing number of items throughout the scale. The removal of misfit items could increase reliability to assess and compare variations in quality evaluations in different patient groups. However, potential consequence of removing misfit items, is reduction in the depth of results, because the misfitting items can provide important clinical information. Therefore, possible reduction of items should be conducted with caution adhering to the theoretical framework behind the instrument.

Limitations

GNCS has been used and revised over the years and has been shown to be a reliable and valid instrument. However, instruments need to be updated and evaluated to keep up with the changing health care organization. The strength of this study lies in the aim to keep the Scale updated and to obtain in-depth knowledge about the psychometric properties of the GNCS. Especially, the instruments using patients' perspective need to be updated due to the changes in health care organizations and nursing care.

The study had some limitations. First, a convenience sample of adult surgical patients and nurses was used. The sample may not be representative when compared to larger population of adult surgical patients and nurses. As for the patients, the sample corresponds to the Finnish population in age, gender and in hospital stay.[41] The data were collected in one university hospital. However, the data were sufficiently large for statistical tests but they do not necessarily describe the contextual variation in the country as a whole.

CONCLUSION

The GNCS demonstrated unidimensionality in both nurse and patient data. However, there are a few items which would benefit from revision to be fitted into Rasch model. These findings indicate that GNCS is a psychometrically sound instrument which can be used in measuring the quality of nursing care in both descriptive and experimental designs. GNCS is one instrument option for the use of patient-centered research and development work in future.

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Table 1. Structure and Content of Good Nursing Care Scale in Patients' and Nurses' Versions[16,27]

QUALITY CATEGORY (Amount of items)	**Content of items (ID/Number of item)***
A. CHARACTERISTICS OF ACTORS (5)	Kindness (A17) Carefulness (A18) Knowledgeable (A19) Service-orientation (A20) Honesty (A21)
B. NURSING ACTIONS (6)	Educational (B22) Professional skills (B23) Self-care support (B24) Listening (B25) Clarification of issues (B26) Encouragement (B27)
C. PRECONDITIONS FOR NURSING CARE (5)	Knowledge of professionals (C28) Evidence-base (C29) Resources needed (C30) Prioritization of patient's good (C31) Professional experience (C32)
D. ENVIRONMENT (5)	Physical safety (D33) Psychological safety (D34) Aseptics (D35) Correct medication (D36) Confirmation of identity (D37)
E. PROCEEDING OF THE PROCESS (6)	Access to care (E38) Collaboration with units (E39) Sufficient length of staying (E40) Knowledge about discharge (E41) Knowledge about complications at home (E42) Knowledge about permissions to do (E43)

F. PATIENT MANAGEMENT STRATEGIES (7)	Experiential (44) Cognitive (45) Functional (46) Ethical (47) Social (48) Economic (49) Bio-physiological (50)
G. COLLABORATION WITH FAMILY MEMBERS/SIGNIFICANT OTHERS (6)	Educational (51) Participation in planning care (52) Participation in evaluation of care (53) Listening (54) Encouragement (55) Reservation of time (56)
Total number of items 40	

* Response scale in all items 1-4 (1= I fully disagree, 2= I partly disagree, 3= I partly agree, 4= I fully agree)

Table 2. Rasch Analysis of 7 Quality Categories of the Good Nursing Care Scale (Patient and Nurse Data)

Statistical approach	**Item misfit**		**Dimensio-nality**	**Separation (person)**	**Person misfit**	**Item misfit**		**Dimensio nality**	**Separation (person)**	**Person misfit**
Criteria	**Mn Sq 0.7-1.4**	**Z < 2.0**	**Over 50%**	**Over 1.5**	**Below 1.4, total 5%**	**MnSq 0.7-1.4**	**Z below 2.0**	**Over 50%**	**Over 1.5**	**Below 1.4, total 5%**
Quality category and item no.	PATIENT DATA					NURSE DATA				
A: Characteristics of actors			47.7	0.59	n=16, 3%			70.0	0.63	n=15, 9%
17	1.14	0.8				0.99	0.0			
18	0.79	-1.2				1.52	2.8			
19	0.95	-0.3				0.85	-0.5			
20	0.84	-2.1				0.73	-2.0			
21	1.71	3.7				1.71	3.7			
B: Nursing actions			48.8	0.77	n=24, 5%			37.8	0.84	n=5, 3%
22	0.74	-2.1				0.96	-0.2			
23	1.49	2.8				1.34	2.0			
24	1.00	2.8				1.19	1.0			
25	1.03	0.3				0.81	-0.9			
26	1.35	-2.1				1.07	0.5			
27	0.76	-2.2				0.97	-0.1			

Table 2 cont.

Statistical approach	**Item misfit**		**Dimensio-nality**	**Separation (person)**	**Person misfit**	**Item misfit**		**Dimensio nality**	**Separation (person)**	**Person misfit**
Criteria	**Mn Sq 0.7-1.4**	**Z < 2.0**	**Over 50%**	**Over 1.5**	**Below 1.4, total 5%**	**MnSq 0.7-1.4**	**Z below 2.0**	**Over 50%**	**Over 1.5**	**Below 1.4, total 5%**
Quality category and item no.	PATIENT DATA					NURSE DATA				
C: Preconditions for care			61.2	0.64	n=25, 5%			69.8	0.94	n=23, 14%
28	1.04	1.4				0.75	-2.1			
29	0.92	-0.8				1.42	2.8			
30	1.18	1.4				0.89	-0.9			
31	0.95	-0.4				1.05	0.5			
32	0.91	-0.6				1.63	4.6			
D: Environment					n=26, 6%			36.0	0.64	n=12, 7%
33	0.80	-1.0	32.0	0.00		0.85	-0.8			
34	0.82	-1.2				0.84	-0.9			
35	0.90	-0.9				1.35	1.8			
36	0.94	-0.3				1.35	1.8			
37	1.68	2.7				0.96	-0.1			
E: Proceeding of the process			43.5	0.37	n=26, 6%			57.7	1.44	n=26, 16%
38	1.03	0.3				1.47	3.3			
39	1.20	2.2				0.64	-3.8			
40	1.23	1.3				1.28	2.0			
41	1.15	1.0				1.0	0.1			
42	0.7	-2.2				0.92	-0.6			

43	0.89	-0.9				1.0	0.1		

Table 2 cont.

Statistical approach	**Item misfit**		**Dimensio-nality**	**Separation (person)**	**Person misfit**	**Item misfit**		**Dimensio nality**	**Separation (person)**	**Person misfit**
Criteria	**Mn Sq 0.7-1.4**	**Z < 2.0**	**Over 50%**	**Over 1.5**	**Below 1.4, total 5%**	**MnSq 0.7-1.4**	**Z below 2.0**	**Over 50%**	**Over 1.5**	**Below 1.4, total 5%**
Quality category and item no.	PATIENT DATA					NURSE DATA				
F: Patients' management strategies			65.7	1.14	n=25, 6%			56.7	1.38	n=23, 14%
44	1.17	2.1				0.88	-0.8			
45	0.91	-0.8				1.12	0.8			
46	1.04	0.4				1.29	2.3			
47	0.96	-0.3				1.12	0.9			
48	1.15	1.0				1.56	3.8			
49	1.11	1.4				0.99	0.0			
50	0.96	-0.3				1.02	0.2			
G: Collaboration with family members/significant others			77.7	1.68	n=26, 8%			57.1	1.64	n=25, 15%
51	1.41	3.8			1.04	1.04	0.4			
52	1.03	0.3			0.84	0.84	-1.3			
53	0.78	-2.6			0.80	0.80	-1.6			
54	0.68	-4.0			1.44	1.44	2.9			
55	0.88	-1.3			1.07	1.07	0.6			
56	1.13	1.3			1.35	1.35	2.6			

Table 3. Overview of the Rasch Analysis of the GNCS (Total Scale)

Aspect of validity measured	**Statistical approach and criteria**	**Results**	
		Patient data (n=476)	**Nurse data (n=167)**
Internal scale validity: • Unidimensionality	Principal component analysis of the residuals: at least 50% of the total variance to be explained by the first latent variable	64.4%	58.9%
• Item	Item goodness-of-fit statistics: infit MnSq values between 0.7-1.4 logits	Misfitting items: 19, 22, 21,35, 36, 37, 39	Misfitting items: 19, 32, 36, 39, 48, 54, 55
Person-response validity	Person goodness-of-fit statistics: infit MnSq values <1.4 logits and z value <2.0	103 / 476 (22%) did not demonstrate acceptable goodness-of-fit	57 / 167 (34%) did not demonstrate acceptable goodness-of-fit
Person-separation validity	Person-separation index: >1.5	2.04	2.71