The organizational analysis for quality improvement in neonatal intensive care in Japan

（新生児集中ケアにおける医療の質向上を目指した組織分析）

佐々木八十子

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Use of the ICU Nurse–Physician Questionnaire (ICU N-P-Q): testing reliability and validity in neonatal intensive care units in Japan

Hatoko Sasaki,[1,2,3] Naohiro Yonemoto,[4] Rintaro Mori,[2] Toshihiko Nishida,[3] Satoshi Kusuda,[3] Takeo Nakayama[1]

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For numbered affiliations see end of article.

Correspondence to
Hatoko Sasaki;
hatokos@hotmail.com

ABSTRACT

Objective: Although communication among health providers has become a critical part of improving quality of care, few studies on this topic have been conducted in Japan. This study aimed to examine the reliability and validity of the Intensive Care Unit Nurse–Physician Questionnaire (ICU N-P-Q) for use among nurses and physicians in neonatal ICUs (NICUs) in Japan.

Methods: A Japanese translation of the ICU N-P-Q was administered to physicians and nurses working at 40 NICUs across Japan, which were participating in the Improvement of NICU Practice and Team Approach Cluster randomized controlled trial (INTACT). We used the principal components analysis to evaluate the factor structure of the instruments. Convergent validity was assessed by examining correlations between the subscales of Communication and Conflict Management of the ICU N-P-Q and the subscales and total score of the Nurse–Physician Collaboration Scale (NPCS). Correlations between the subscales of Communication and Conflict Management by correlation with scales that refer to performance, including Job Satisfaction and Unit Effectiveness, were calculated to test the criterion validity.

Results: In total, 2006 questionnaires were completed by 316 physicians and 1690 nurses. The exploratory factor analysis revealed 15 factors in the physicians' questionnaire and 12 in the nurses' questionnaire. Convergent validity was confirmed, except for 'Between-group Accuracy' and 'Cooperativeness' in the physicians' scale, and for 'Between-group Accuracy' and 'Sharing of Patient Information' in the nurses' scale. Correlations between the subscales of communication and outcomes were confirmed in the nurses' questionnaire but were not fully supported in the physicians' questionnaire.

Conclusions: Although the psychometric property behaved somewhat differently by occupation, the present findings provide preliminary support for the utility of the common item structure with the original scale, to measure the degree and quality of communication and collaboration among staff at NICUs and similar healthcare settings in Japan.

Trial registration number: UMIN000007064; Pre-results.

Strengths and limitations of this study

- This is the first study to reveal the psychometric properties of the Intensive Care Unit Nurse–Physician Questionnaire (ICU N-P-Q) in a Japanese sample with a large number of working units.
- The present findings provided preliminary support for the Japanese ICU N-P-Q, which can be used to measure the extent and quality of communication/collaboration among medical and nursing staff at neonatal ICUs (NICUs) and similar healthcare settings in Japan.
- Examining the questionnaires for physicians and nurses separately may have revealed the psychometric properties more accurately than did the original study, which had a combined nurse–physician sample.
- Some items were deleted from the questionnaire due to copyright restrictions. Therefore, the data in this study cannot fully compare with the psychometric property of the original study.

INTRODUCTION

Good relationships among staff in healthcare organisations are an essential factor to provide safe and high-quality care. Previous studies have observed that better communication and collaboration among healthcare providers is associated with higher technical quality of care,[1] lower length of stay,[2] superior clinical care in disease[3] and risk-adjusted morbidity.[4] Communication and collaboration among health professionals have been shown to make an impact on patient outcomes. A Cochrane Database of systematic Reviews[5] found that practice-based interprofessional collaboration interventions enhanced healthcare processes and outcomes; however, generalising the core components of interprofessional collaboration interventions and their effectiveness remains an ongoing challenge.

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The aspects of communication include the degree to which physicians or nurses can carry out discussions without fear of repercussions or misunderstanding, the degree to which they believe in the consistent accuracy of the information conveyed by others, and the degree to which patient care information is relayed promptly to the people who need to be informed.[6] Collaboration can be defined as the process where nurses and physicians work together in the delivery of quality care, jointly contributing in a balanced relationship characterised by mutual trust.[7] There is a great deal of overlap between communication and collaboration; as Shortell *et al*[8] described, collaboration involves open and timely communication, integration of individuals' varied work activities, and ensuring that all available expertise is brought together to support problem-solving and conflict resolution. To advance our understanding of the impact and effectiveness of communication and collaboration on patient outcomes, it is critical to accurately assess the degree and quality of communication and collaboration among health professionals. A recent systematic review of survey instruments for measuring teamwork in healthcare settings identified 36 scales which met the study criteria.[9] Twelve of the 36 scales documented relationships between teamwork and objective outcomes of interest in peer-reviewed studies.[9] Another systematic review[10] of survey instruments for assessing collaboration in healthcare settings found five instruments that met the study criteria for psychometric validity. The Intensive Care Unit Nurse–Physician Questionnaire (ICU N-P-Q)[8] was one of the two scales identified by both reviews as a useful valid scale for future research.

The ICU N-P-Q was originally developed using a large national sample to measure collaboration at the ICU level and organisational components that facilitate a collaborative clinical interaction. The scale has been used to assess perceptions of nurse–physician collaboration in critical and non-critical care in the USA[11–14] and the UK.[15] A part of the scale was also used to assess leadership, disagreements and authority within the context of a neonatal ICU (NICU).[16] The biggest difference between an ICU and an NICU is the body size of patients. Medication dosages of neonatal patients depend on their weight, and a large NICU is likely to have a much wider variety of diagnoses as compared with a small NICU. The number of beds is slightly larger in NICUs than in ICUs in Japan.[17] Therefore, interprofessional communication in NICUs could be different from general ICUs and other healthcare groups, even in Japan. In this study, we aimed to examine the reliability and validity of the translated ICU N-P-Q among nurses and physicians from NICUs across Japan.

METHODS

Translation process

Permission to use the ICU N-P-Q and create a Japanese version was obtained from the original authors. A professional translator of Japanese translated the original English version into Japanese, after which a different professional translator conducted back translation of the scale. However, two components of the scale (workplace and facility safety scales/culture) were not translated or included because of copyright restrictions. In order to maintain quality control, the back translation was shared with Dr Stephen M Shortell, Principal Investigator of the original study.[8] After two authors (HS and RM) assessed the expressions used in the Japanese ICU N-P-Q, a pretest was performed on 30 physicians and 124 nurses from three preintervention facilities, which were participating in a trial known as the Improvement of NICU Practice and Team Approach Cluster randomized controlled trial (INTACT). The pretest aimed to assess whether the Japanese ICU N-P-Q was appropriate and easily understandable for nursing and physician personnel. The Japanese ICU N-P-Q was finalised after some modifications were made to the wording in response to pretest feedback.

Ethical considerations

Participation in this study was voluntary and written consent was obtained from each participant. Anonymity and confidentiality of the data were assured to all participants.

Sample and data

In this study, we used baseline data from a questionnaire distributed to physicians and nurses working at 40 NICUs that were participating in INTACT and located in different areas of Japan. Questionnaires were distributed to 345 physicians and 1800 nurses. The unlinked anonymous survey was administered from December 2011 to March 2012. We excluded data from the analysis if there were missing values for any variables in the ICU N-P-Q, and if all or almost all of the items in each subscale were scored with the same number (eg, scored '1' in all values).

Instrument

ICU Nurse–Physician Questionnaire

The original ICU N-P-Q is a 120-item scale derived from the Organizational Culture Inventory with response items ranked on a five-point Likert scale ranging from 1=strongly disagree to 5=strongly agree.[8] A revised and shortened version of the instrument is also available as an 81-item scale. In this study, we used the shorter version. Although a separate test for reliability and validity has not been completed for the shorter version, the authors who developed the ICU N-P-Q believed that the shorter version was easier to administer and was therefore able to achieve better survey compliance while ensuring good validity and reliability.[18] Two components of the scale (workplace and facility safety scales/culture) were excluded because of copyright restrictions.[19] The subscales of the ICU N-P-Q consist of Leadership, Communication, Coordination, Conflict Management,

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Unit Effectiveness and Authority, and a single item on Job Satisfaction. The scale includes separate questionnaires for physicians and nurses. Shortell *et al*[8] reported that Cronbach's α reliabilities ranged from 0.61 to 0.88 for subscales. Other researchers have reported reliabilities from 0.66 to 0.92.[11 13 14 20]

Nurse–Physician Collaboration Scale (NPCS)

The NPCS[21] was developed to measure collaboration between nurses and physicians in Japan. The questionnaire is a 27-item scale and consists of three subscales: Joint Participation in Care, Sharing of Patient Information and Cooperativeness. Participants rate how often they experience these positive work-related states using a seven-point Likert scale ranging from 1='never' to 7='always/every day'. Cronbach's α reliabilities for nurses' responses to the subscales ranged from 0.80 to 0.92, and that for physicians' responses ranged from 0.84 to 0.93. Psychometric testing showed that the NPCS was reliable and valid with high internal consistency and the results for test–retest reliability were adequate. Similar to the ICU N-P-Q, the NPCS focuses on nurses' and physicians' collaborative and problem-solving skills.[21] In this study, the NPCS was administered to test convergent validity of the Japanese ICU N-P-Q.

Conceptual framework

The conceptual framework of this study was based on the analytic framework of managerial and organisational factors affecting ICU performance, which was developed by Shortell *et al*.[8] This concept focuses on the identification of main managerial practices and organisational processes that might influence effective performance. The important consideration is that these practices and processes are under the control of managers. According to this theory, organisational culture, leadership, communication, coordination and problem-solving should be included in these practices and processes. Specifically, a complex environment, such as that observed in ICUs, requires effective teamwork. More open, accurate and timely communication, as well as more open collaborative problem-solving approaches, would produce more effective patient care and improve health providers' occupational satisfaction.[4 22 23] The ICU N-P-Q consists of the Leadership and Authority scales assessing organisational factors, Communication and Conflict Management scales measuring the degree and quality of communication and collaboration within and between groups, and Unit Effectiveness and Job Satisfaction scales indicating outcomes of communication and collaboration. This study mainly focused on validating the Communication and Conflict Management scales of the ICU N-P-Q.

Statistical analysis

All statistical analyses were undertaken in SPSS V.21.0 (IBM Corp, USA). The p value of ≤0.05 was considered statistically significant.

Item analysis and reliability

First, the normality of the distribution of the scores was checked for each item using means, SDs, and skewness and kurtosis, and then the corrected item-total correlations and corrected item-subscale Cronbach's α were calculated separately for the physicians' and nurses' scales of the ICU N-P-Q. Items with corrected item-total correlations <0.3,[24] and items with corrected item-subscale Cronbach's α >0.8 were identified for possible exclusion from the scale.

Factor analysis

An exploratory factor analysis was conducted using a maximum likelihood solution method with promax rotation. The latent root criterion was used to decide the number of factors extracted, and factors having eigenvalues greater than 1 were considered significant. The Kaiser-Meyer-Olkin (KMO) was applied to measure the strength of the relationship among variables. KMO values greater than 0.7 are acceptable and values between 0.8 and 0.9 indicate a strong relationship.[25] Factor loadings >0.4 were retained. If an item loaded equally on two factors, we dropped the item from the scales. Finally, means, SDs and internal consistency of the items were calculated for the factors that result from factor analysis. We also calculated interfactor correlations.

Validity

Convergent validity of the Communication and Conflict Management scales of the N-P-Q was assessed by means of the scales and total score of the NPCS, in which items are thought to reflect the fundamental aspects of the nurse–physician relationships. The Communication and Conflict Management scales of the N-P-Q included 'Within-group Accuracy', 'Between-group Accuracy', 'Between-group Avoiding Conflict Strategy' and 'Between-group Problem-solving Conflict Strategy' because the NPCS only examines the relationships between physicians and nurses. We assumed that the NPCS would have a positive correlation with the Japanese ICU N-P-Q. We also tested the criterion validity of the Communication and Conflict Management scales by examining their correlation with scales that refer to performance, including Job Satisfaction and Unit Effectiveness.

RESULTS

Description of sample

A total of 2006 questionnaires were completed by 316 physicians (response rate=92%) and 1690 nurses (response rate=94%). After excluding missing values and values scored with the same numbers, 1762 questionnaires were used in the analysis, including those of 285 physicians and 1475 nurses. Of the 285 participating physicians, 57 (20%) were head physicians, 200 (70.2%) were physicians, 24 (8.4%) were residents and there

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were 4 missing values. Of the 1475 participating nurses, 130 (8.8%) were head nurses, 1328 (90.0%) were nurses, 2 (1.0%) were assistant nurses and there were 15 missing values (1.0%). The highest number of practice years in one's own unit was 5–9 years for nurses and <1 year for physicians (table 1).

Item analysis and reliability

Sixteen items were identified for possible exclusion from the physicians' scale. These included 3 items with corrected item-total correlations <0.3 (number 1, 9 and 38), and 13 items with corrected item-subscale Cronbach's α >0.8 (number 1, 9, 12, 24, 44, 45, 48, 51, 53, 66, 67, 68 and 75). Similarly, 14 items were identified for possible exclusion from the nurses' scale. These included five items with corrected item-total correlations <0.3 (number 1, 4, 9, 12 and 38), and nine items with corrected item-subscale Cronbach's α >0.8 (number 30, 31, 32, 44, 49, 51, 66, 67 and 68) (see online supplementary appendix 1). Three of the four items in the 'Between-group Communication Openness' were dropped due to Cronbach's α >0.8, and therefore the remaining item (number 29) was deleted for the factor analysis.

Factor analysis

The factor analysis for the physicians' scale returned to 15 factors (KMO=0.83, p<0.001) (see online supplementary appendix 2). These 16 factors explained 56.3% of the observed variance. Nine items were dropped because three of them loaded <0.4. The following items that originally belonged to separate subscales were combined into one factor: two items on 'Within-group Avoiding Conflict Strategy' and three items on 'Between-group Avoiding Conflict Strategy', two items on 'Within-group Problem-solving Conflict Strategy' and three items on 'Between-group Problem-solving Conflict Strategy', three items on 'Absolute Technical Quality of Care' and one item on 'Perceived Effectiveness at Meeting Family Member Needs', and three items on 'Nursing Director Budgeting Authority' and two items on 'Nursing Director Patient Care Authority'.

The factor analysis revealed 12 factors in the nurses' scale (KMO=0.88, p<0.001) (see online supplementary appendix 3). The 12-factor solution accounted for 45.8% of the total variance. Nine items with factor loadings <0.4 were deleted. The following items that originally belonged to separate subscales were combined into one factor: three items on 'Within-group Avoiding Conflict Strategy' and three items on 'Between-group Avoiding Conflict Strategy'; three items on 'Within-group Problem-solving Conflict Strategy' and two items on 'Between-group Problem-solving Conflict Strategy'; one item on 'Perceived Effectiveness at Recruiting and Retaining Nurses', one item on 'Perceived Effectiveness at Recruiting and Retaining Physicians', two items on 'Absolute Technical Quality of Care', and one item on 'Perceived Effectiveness at Meeting Family Member Needs'. Other items of physicians' and nurses' scales had the same factor structures reported by the original study.

Table 1 Sample characteristics

	Physicians (N=285) n (%)	Nurses (N=1475) n (%)
Sex		
Male	195 (68.4)	25 (1.7)
Female	87 (30.5)	1430 (96.9)
Missing	3 (1.1)	20 (1.4)
Status		
Head physician	57 (20.0)	–
Physician	200 (70.2)	–
Resident	24 (8.4)	–
Missing	4 (1.4)	–
Head nurse	–	130 (8.8)
Nurse	–	1328 (90.0)
Assistant nurse	–	2 (1.0)
Missing	–	15 (1.0)
Years of practice		
<1	79 (27.7)	281 (19.0)
1–2	49 (17.2)	330 (22.4)
3–4	55 (19.3)	304 (20.6)
5–9	53 (18.6)	336 (22.8)
>10	46 (16.1)	208 (14.1)
Missing	3 (1.1)	16 (1.1)

Validity

Convergent and criterion validity

Correlations of the Communication and Conflict Management subscales of the ICU N-P-Q with the subscales and total score of the nurse–physician collaboration scale (NPCS) have been shown in table 2. Since the factor solutions did not reveal clear within-groups and between-groups distinctions for 'Avoiding Conflict Strategy' and 'Problem-solving Conflict Strategy', these scales were not included in the correlation matrix. A positive correlation was observed between the physicians' scale and the NPCS, except for 'Between-group Accuracy' and 'Cooperativeness' (r=0.081, p=0.173). Similarly, a positive correlation was observed between the nurses' scale and the NPCS, except for 'Between-group Accuracy' and 'Sharing of Patient Information' (r=0.036, p=0.162).

The correlations between the subscales on communication/collaboration (Communication, Coordination and Conflict Management) and the subscales on performance (Job Satisfaction and Unit Effectiveness) in the ICU N-P-Q have been shown in table 3. Positive correlations were observed for the physicians' subscales, except for 'Within-group Openness' and 'Perceived Effectiveness at Recruiting and Retaining Nurses' (r=0.096, p=0.11). There were positive correlations for all the subscales of the nurses' scale.

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Table 2 Correlation coefficients (Pearson r) for the subscales on communication/collaboration of the ICU Nurse–Physician Questionnaire with the subscales and total score of the NPCS

		NPCS															
		Joint Participation in Care				Sharing of Patient Information				Cooperativeness				Total			
		Doctor		Nurse		Doctor		Nurse		Doctor		Nurse		Doctor		Nurse	
	Subscales	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value
ICU Nurse–Physician Questionnaire	Between-group Openness	0.270	<0.001	NA		0.248	<0.001	NA		0.525	<0.001	NA		0.402	<0.001	NA	
	Between-group Accuracy	0.224	<0.001	0.154	<0.001	0.117	<0.048	0.036	0.162	0.080	0.173	0.073	<0.005	0.155	<0.009	0.098	<0.001

ICU, intensive care unit; NA, not applicable; NPCS, Nurse–Physician Collaboration Scale.

Table 3 Correlations between the subscales on communication/collaboration and the outcomes

			Subscales of Communication/Collaboration													
			Unit Relations with Other Units		Within-group Openness		Within-group Accuracy		Between-group Openness		Between-group Accuracy		Avoiding Conflict		Problem-solving Conflict	
			Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value	Correlation	p Value
Subscales of Outcome	Perceived effectiveness nurses	Doctor	0.162	<0.006	0.096	0.105	0.202	<0.001	0.155	<0.009	0.256	<0.001	0.216	<0.001	0.257	<0.001
		Nurse	0.225	<0.001	0.107	<0.001	0.148	<0.001	NA		0.115	<0.001	0.183	<0.001	0.230	<0.001
	Absolute technical quality of care/effectiveness at meeting family member needs	Doctor	0.228	<0.001	0.341	<0.001	0.325	<0.001	0.168	<0.004	0.261	<0.001	0.263	<0.001	0.444	<0.001
		Nurse	0.318	<0.001	0.207	<0.001	0.243	<0.001	NA		0.214	<0.001	0.298	<0.001	0.432	<0.001
	Satisfaction	Doctor	0.231	<0.001	0.395	<0.001	0.250	<0.001	0.192	<0.001	0.117	<0.052	0.192	<0.001	0.343	<0.001
		Nurse	0.324	<0.001	0.440	<0.001	0.198	<0.001	NA		0.106	<0.001	0.230	<0.001	0.276	<0.001

NA, not applicable.

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Description of the scales

The lowest score was given for 'Between-group Communication Accuracy' (physician: mean=2.86, SD=0.73) and 'Perceived Effectiveness at Recruiting and Retaining' (nurse: mean=3.00, SD=0.56). The highest scores were given for 'Within-group Communication Openness' (physician: mean=3.95, SD=0.71) and 'Avoiding Conflict Strategy' (nurse: mean=3.70, SD=0.60). Almost all of the subscales demonstrated good to high reliability for physicians ranged from 0.54 to 0.89 and for nurses ranged from 0.51 to 0.87. The lowest α value was found in 'Perceived Effectiveness at Recruiting and Retaining' for physicians with 0.54 and for nurses with 0.51. The interfactor correlation ranged from −0.03 to 0.58 in physicians and from −0.01 to 0.54 in nurses. Negative interfactor correlations were found between Factor 1 and Factor 13, Factor 3 and Factor 13, Factor 4 and Factor 13, Factor 7 and Factor 13, Factor 11 and Factor 13, and Factor 12 and Factor 13 for physicians. Interfactor correlation between Factor 1 and Factor 11, and between Factor 11 and Factor 12, was negative correlation for nurses (see online supplementary appendices 4 and 5).

DISCUSSION

Main findings

This is the first study to reveal the psychometric property of the ICU N-P-Q in a Japanese sample with a large number of working units. Fifteen of the 21 scales for physicians, and 12 of the 21 scales for nurses, were retained as a result of the factor analysis. The factor structure and interfactor correlations were in the theoretically unexpected directions for both scales, where there was no distinction between the within-group and between-group factor solutions on 'Avoiding Conflict Strategy' and 'Problem-solving Conflict Strategy'. Convergent validity was confirmed by assessing correlations between the NPCS and the Communication and Conflict Management subscales of the ICU N-P-Q, except for 'Between-group Accuracy' and 'Cooperativeness' from the physicians' scale and 'Between-group Accuracy' and 'Sharing of Patient Information' from the nurses' scale. With reference to concurrent validity, the predicted relationships between the subscales of communication and outcomes were confirmed in the nurses' questionnaire but were not fully supported in the physicians' questionnaire.

Explanation and interpretation

The number of factors in the physicians' scale was not identical with that in the nurses' scale, where the 'Absolute Technical Quality of Care' was combined with 'Perceived Effectiveness at Meeting Family Member Needs' in both scales. This suggests that the items in these two subscales may not group well. There was no distinction between the within-group and between-group factor solutions on 'Avoiding Conflict Strategy' and 'Problem-solving Conflict Strategy'. This may be because the conflicts between nurses and physicians are due to the overlapping nature of their domains and the lack of clarity regarding their roles,[26] and they differ in terms of their beliefs about responsibility, barriers to progress and possible solutions to the problem.[27] In some NICUs, nurses indeed fulfil a part of the physicians' role in Japan.

'Cooperativeness' in the NPCS did not correlate with the 'Between-group Accuracy' of the ICU N-P-Q for physicians, while 'Sharing of Patient Information' in the NPCS did not associate with the 'Between-group Accuracy' of the ICU N-P-Q for nurses. Although there are correlations between 'Cooperativeness' and 'Between-group Accuracy' for nurses, and 'Sharing of Patient Information' and 'Between-group Accuracy' for physicians, these correlations are weak. 'Cooperativeness' and 'Sharing of Patient Information' in the NPCS may not have reflected concepts similar to the 'Between-group Accuracy' subscale in the ICU N-P-Q.

Although Cronbach's α coefficients for the nurses' and physicians' questionnaires were mostly acceptable, they were not fully comparable with the original validation study[8] and previous studies using the ICU N-P-Q,[11–14] which had a combined nurse–physician sample. The lowest reliability was found in the subscale 'Perceived Effectiveness at Recruiting and Retaining' for both questionnaires. To enhance the subscale's consistency, the items could be refined by several additional statements. It is important to consider these aspects when administering the scale.

Two issues need to be examined in future studies. First, the construct validity of the original English version needs to be examined more closely because though the ICU N-P-Q is one of the well-known measures on the organisational culture and communication in healthcare settings,[10] the questionnaire has been used only partially.[4 11 12 19] This also restricts comparison across studies and countries. Second, the findings of the present study revealed that several subscales are different constructs of the original scales. We did not rename or eliminate these subscales in this study because further validity would clarify why several subscales that originally belonged to separate scales were combined in this study, and how these can be distinct constructs.

This study examined the questionnaires for physicians and nurses separately. Therefore, the present results may have revealed the psychometric properties more accurately than did the original study, which had a combined nurse–physician sample, and highlighted some points for further research concerning the difference between perceptions of physicians and nurses. Considering the burden of administration time and the response rate to the short version of the 81-item scale, it might be a better approach to use only selected parts of the scales depending on the purpose of individual studies and researchers' specific interests, as previous studies have done.[11–13 19]

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Limitations

This present study has a few limitations. First, two components (workplace and facility safety scales/culture) of the original instrument were not available because of copyright restrictions. Second, some items and subscales (eg, 'Team Cohesion', 'Understanding', 'Satisfaction with Nurse Communication', 'Satisfaction with Physician Communication', 'Within-group Forcing', 'Between-group Forcing', 'Within-group Arbitration' and 'Between-group Arbitration') were not included in the shorter version of the physician and nurse questionnaires. Therefore, the data in this study cannot fully compare with the psychometric property of the original study. Third, the NPCS measures the cooperation between physicians and nurses, and therefore examination of the scale correlations only with the two subscales assessing openness and accuracy between groups was appropriate for testing the convergent validity. Finally, this study could not determine whether the differences in the factorial structure are caused by the sample characteristics or cultural differences, since the original study did not perform an item analysis or factor analysis.

CONCLUSION

Although the psychometric property of the Japanese ICU N-P-Q acted slightly differently in this study according to occupation, the present findings provide preliminary support for the utility of the common item structure of the original scale to measure the extent and quality of communication and collaboration among medical and nursing staff at NICUs and similar healthcare settings in Japan.

Author affiliations
[1]Department of Health Informatics, School of Public Health, Kyoto University, Kyoto, Japan
[2]Department of Health Policy, National Center for Child Health and Development, Tokyo, Japan
[3]Department of Neonatology, Maternal and Perinatal Center, Tokyo Women's Medical University, Tokyo, Japan
[4]Department of Biostatistics, Kyoto University School of Public Health, Kyoto, Japan

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Contributors HS administered the survey, acquired the data, performed the statistical analysis, and prepared the draft. NY provided supervision of the study design, the data analysis and interpretation. RM supervised the design of the study. TNi and SK managed the whole research process. TNa supervised the data analysis and critically revised the manuscript for important intellectual content. All authors were involved in the critical commentary and approved the final version of the manuscript.

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Competing interests None declared.

Ethics approval Ethical approval was obtained on 15 July 2011 from the independent review board of Improvement of NICU Practice and Team Approach Cluster randomized controlled trial (INTACT: UMIN000007064), which has its administrative office in Tokyo Women's Medical University. This study was also approved by the Ethics Committee of the Kyoto University Graduate School and Faculty of Medicine on 28 March 2014.

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Use of the ICU Nurse–Physician Questionnaire (ICU N-P-Q): testing reliability and validity in neonatal intensive care units in Japan

Hatoko Sasaki, Naohiro Yonemoto, Rintaro Mori, Toshihiko Nishida, Satoshi Kusuda and Takeo Nakayama

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Article

Assessing archetypes of organizational culture based on the Competing Values Framework: the experimental use of the framework in Japanese neonatal intensive care units

HATOKO SASAKI[1,2], NAOHIRO YONEMOTO[3], RINTARO MORI[2], TOSHIHIKO NISHIDA[2], SATOSHI KUSUDA[4], and TAKEO NAKAYAMA[1]

[1]Department of Health Informatics, School of Public Health, Kyoto University, Yoshida Konoe Sakyo, Kyoto 606-8501, Japan, [2]Department of Health Policy, National Research Institute for Child Health and Development, National Center for Child Health and Development, 2-10-1 Okura, Setagaya, Tokyo 157-8535, Japan, [3]Department of Biostatistics, School of Public Health, Kyoto University, Yoshida Konoe Sakyo, Kyoto 606-8501, Japan, and [4]Department of Neonatology, Maternal and Perinatal Center, Tokyo Women's Medical University, 8-1 Kawada-cho, Sinjuku, Tokyo 162-8666, Japan

Address reprint requests to: Hatoko Sasaki, Department of Health Policy, National Research Institute for Child Health and Development, National Center for Child Health and Development, 2-10-1 Okura, Setagaya, Tokyo 157-8535, Japan. Tel: +81-3-3416-0181; Fax: +81-3-3417-2694; E-mail: hatokos@hotmail.com

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Abstract

Objective: To assess organizational culture in neonatal intensive care units (NICUs) in Japan.
Design: Cross-sectional survey of organizational culture.
Setting: Forty NICUs across Japan.
Participants: Physicians and nurses who worked in NICUs ($n = 2006$).
Main Outcome Measures: The Competing Values Framework (CVF) was used to assess the organizational culture of the study population. The 20-item CVF was divided into four culture archetypes: Group, Developmental, Hierarchical and Rational. We calculated geometric means (gmean) and 95% bootstrap confidence intervals of the individual dimensions by unit and occupation. The median number of staff, beds, physicians' work hours and work engagement were also calculated to examine the differences by culture archetypes.
Results: Group (gmean = 34.6) and Hierarchical (gmean = 31.7) culture archetypes were higher than Developmental (gmean = 16.3) and Rational (gmean = 17.4) among physicians as a whole. Hierarchical (gmean = 36.3) was the highest followed by Group (gmean = 25.8), Developmental (gmean = 16.3) and Rational (gmean = 21.7) among nurses as a whole. Units with dominant Hierarchical culture had a slightly higher number of physicians (median = 7) than dominant Group culture (median = 6). Units with dominant Group culture had a higher number of beds (median = 12) than dominant Hierarchical culture (median = 9) among physicians. Nurses from units with a dominant Group culture (median = 2.8) had slightly higher work engagement compared with those in units with a dominant Hierarchical culture (median = 2.6).
Conclusions: Our findings revealed that organizational culture in NICUs varies depending on occupation and group size. Group and Hierarchical cultures predominated in Japanese NICUs. Assessing organizational culture will provide insights into the perceptions of unit values to improve quality of care.

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Key words: quality improvement, quality management, intensive care, setting of care

Introduction

Organizational culture is described as the reflection of values, dominant leadership styles, the language and symbols, the procedures and routines, and the definitions of success that make an organization unique [1]. The most common definition of organizational culture is that by Schien [2], who describes it as 'a pattern of shared basic assumptions that a group has learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems'. The study of organizational culture began in the 1980s, and understanding organizational culture has become an essential approach to implementing strategic management in the business field. Similarly, organizational culture in the healthcare industry has also been drawing much attention since the late 1990s, as it has been recognized as an important contributor to healthcare quality and performance. Organizational values and beliefs often focus on quality of care and patient safety, and there is strong evidence of these values in most healthcare organizations [3]. Notably, organizational culture has been shown to have an impact on job satisfaction [4–6], employee turnover [7], patient satisfaction [5, 8], quality improvement [9], guideline adherence [10] and performance outcomes [11].

Studies have suggested that a cooperative culture is associated with improved patient outcomes in neonatal intensive care, such as a decrease in mortality of preterm infants [12] and higher safety performance [13]. Conversely, there is an argument that the interpretation of results should be done with a degree of caution due to methodological weakness [14, 15]. Considering that organizational culture in healthcare may be a critical indicator of quality improvement, measuring organizational culture is increasingly needed for organizations to identify enhancements and barriers to implementing quality improvement. A number of instruments have been developed to measure organizational culture and have been used in several studies to assess organizational culture in healthcare [16–19]. For example, the Competing Values Framework (CVF) is commonly used in the healthcare setting [20–23]. To date, however, no studies, including but not limited to healthcare settings, have taken into account the nature of fixed choice (ipsative data) of the CVF scales [6, 8, 9, 20, 22–25].

While Japan is a country with one of the lowest infant mortality rates in the world, practice variations and disparities in the morbidity and mortality of very low birth weight infants have been found among neonatal intensive care units (NICUs) [26]. There are multiple clinical and nonclinical factors behind these variations and disparities among facilities, and organizational culture might differ depending on practice performance. Differences in organizational culture in the context of quality improvement of NICUs have not yet been investigated in Japan. This study, therefore, analyzed ipsative data with the view to assess the organizational culture of NICUs in Japan.

Methods

Sample and data

We used baseline data from a self-administered questionnaire for physicians and nurses at 40 NICUs across Japan that participated in the Improvement of NICU Practice and Team Approach Cluster randomized controlled trial (INTACT) [27]. INTACT aimed to improve the outcomes of very low birth weight infants by conducting a multifaceted intervention, which consisted of (i) comprehensive feedback of facility profiles, (ii) on-site educational workshops, (iii) assistance in the development and implementation of action plans and (iv) audits of the status of action plans to provide advice. Questionnaires were distributed to 345 physicians and 1800 nurses. The unlinked anonymous survey was conducted from December 2011 to March 2012.

Ethical consideration

Participation in the study was voluntary and written consent was obtained from each participant. Anonymity and confidentiality of data was assured to all participants. Ethical approval was obtained on 15 July 2011 from the independent review board of INTACT (UMIN000007064), which has its administrative office located at Tokyo Women's Medical University. This study was also approved by the Ethics Committee of Kyoto University Graduate School and Faculty of Medicine on 28 March 2014.

Instrument

Competing Values Framework

The original CVF instrument comprised 16 items validated by Quinn and Spreizer [28]. We used a modified 20-item version from the Quality Improvement Implementation Survey created by Shortell [9] for use in the hospital environment, and included the CVF scales adapted from Zammuto and Krakowe [29]. Shortell's 20-item version is divided into four organizational culture archetypes, measuring over five organizational dimensions: facility character, cohesion, managers, emphasis and facility rewards. The four organizational culture archetypes are referred to as Group, Developmental, Hierarchical and Rational. Group culture focuses on norms and values associated with affiliation, teamwork and participation. This archetype has an internal focus and emphasizes flexibility. Developmental culture focuses on risk-taking innovation and change. This has an external focus and emphasizes flexibility. Hierarchical culture reflects the values and norms associated with bureaucracy. This has an internal focus and emphasizes control. Rational culture focuses on efficiency, productivity and achievement. This archetype has an external focus and emphasizes control. There are two versions of the instrument, Likert scales and ipsative scales. Quinn and Spreizer found that both versions of the instrument conformed to the CVF, and items among the four subscales correlated as predicted in the model [28]. Cronbach Alphas on CVF Likert scales were 0.76–0.90 for Group culture; 0.77–0.86 for Development culture; 0.62–0.70 for Hierarchical culture; and 0.71–0.80 for Rational culture [30–32]. In the present study, we used ipsative scales in which respondents allocated 100 points among four items of each cultural dimension according to how well each item described the organization relative to the other items.

Utrecht Work Engagement Scale Japan (UWES-J)

Work engagement was measured using the Japanese 9-item (α = 0.92) short version of the Utrecht Work Engagement Scale Japan [33]. The three sub-dimensions of vigor, dedication and absorption

were each represented by three items (e.g. 'At my job, I feel strong and vigorous'; 'I am enthusiastic about my job'; and 'I feel happy when I work intensely'). Respondents rate how often they experience these positive work-related states, using a 7-point scale from 1 = 'never' to 7 = 'always/every day'.

Translation process

The 20-item CVF instrument was translated into Japanese from English by a professional translator, and then back translated by a different translator. To maintain quality control, the back translation was shared with Dr. Stephen M. Shortell, Principal Investigator of the original study [8]. After two authors (H.S. and R.M.) assessed the expressions used in the Japanese CVF, a pretest was performed on 30 physicians and 124 nurses from three pre-intervention facilities that participated in INTACT. The pretest was performed to see whether the Japanese CVF would be appropriate and easily understood. Based on the results of the pretest, the translation was modified and finalized.

Ipsative scales

Ipsative data are scale scores for respondents that always add to the same total [34]. Because the measurement approach requires respondents to allocate a fixed number of points among four culture archetypes, the number of points a respondent assigns to one type of culture affects the number of points he or she assigns to the other types of culture [8]. In these kinds of fixed scales, items are grouped in item sets, and respondents must compare options instead of selecting the most desirable alternative, as is the case with normative scores such as Likert-type scales [35].

Because of the holistic nature of organizational culture, the quadrants (Group, Developmental, Hierarchical and Rational) of CVF scales are interdependent [36]. The ipsative scales maintain the quadrants' interdependence [28]. Thus, ipsative scales are suitable for use when correlating cases and undertaking Q factor analysis [37]. Considering this feature, ipsative scales are not appropriate for correlations-based analysis such as factor analysis and regression [28].

Statistical analysis

We excluded data from analysis if there was a missing value on any variable in the CVF instrument and if the sum of each subscale was not 100 points. We calculated means and confidence intervals (CIs) of the individual dimensions by hospital and occupation. Hospitals were classified according to the founder. We also calculated median number of staff, beds, physicians' work hours and work engagement to investigate the differences by hospital types and culture archetypes.

The analysis of ipsative data, however, is problematic because standard statistical analyses yield biased results [35]. Van Eijnattan *et al.* [35] proposed an alternative statistical method to take into account the ipsative nature of the CVF: the closed part-wise geometric mean, the nonparametric bootstrap 95% CIs and envelopes. Construction of 95% bootstrap CIs is described as follows: (i) extract nonparametric samples from the data, (ii) compute collective dimensional profiles (CDP) for each of the bootstrap samples with the closed part-wise geometric means, (iii) compute the Aitchison distance [38] for each bootstrap CDP, (iv) delete the CDP pertaining to the 5% largest Aitchison distance and (v) determine the upper and lower bounds of each CI based on the highest and lowest values for each component of the remaining 95% of the bootstrap mean CDPs. The suggested approach satisfies basic statistical requirements for the analysis of ipsative data: scale invariance, permutation variance and subcompositional coherence [35]. This approach can correctly compute and compare organizational culture profiles within the same organization. On the other hand, Van Eijnattan *et al.* argued that the problem of drawing inter-organization contrasts in ipsative scales still remains uncertain. Thus, we can only interpret our results as a relative comparison between organizations. We did not test psychometric property of the scales in this study because correlation-based analysis and factor analysis are not suitable to ipsative data, as explained above. Although there are some statistical limitations on ipsative scales, we gave priority over its merits and applied this method to analyze our data in this study.

All statistical analyses were undertaken in R-software package 'compositions' [39–41] and SPSS version 21.0 (IBM Corporation, USA). The syntax of R program was obtained from Van Eijnattan [35].

Results

Description of sample

A total of 2006 questionnaires were completed by 316 physicians (response rate = 92%) and 1690 nurses (response rate = 94%). The high response rate was achieved due to the provision of feedback results to each NICU. After excluding missing values and values scored with the same numbers, the final data for analysis were 1758, including 289 physicians and 1469 nurses. The 289 physicians consisted of 56 (19.4%) managerial doctors, 206 (71.3%) doctors, 23 (8.0%) residents and 4 (1.4%) unknown. The 1469 nurses consisted of 124 (8.4%) managerial nurses, 1324 (90.1%) nurses, 3 (0.2%) assistant nurses and 18 (1.2%) unknown. The highest number of years of practice in their own unit was 1–2 years for nurses and less than 1 year for physicians (Table 1).

Means and CIs of culture archetypes

The hospitals consisted of one Red Cross hospital, 10 university hospitals, 13 private hospitals, 10 public hospitals and 6 national

Table 1 Characteristics of NICUs and their staff

	N	%
Neonatal intensive care units	40	100
Facility type		
Public	24	60.0
Private	10	25.0
Other	6	15.0
Number of beds in unit		
6–9	17	42.5
10–13	11	27.5
14–17	3	7.5
18–21	7	17.5
>22	2	5.0
Staff	1736	100
Head physician	56	3.3
Staff physician	229	13.2
Head nurse	124	7.1
Staff nurse	1327	76.4
Years of working experience		
Less than 1 year	367	21.1
1–2 years	385	22.2
3–4 years	366	21.1
5–9 years	383	22.1
More than 10 years	235	13.5

hospitals. Among 40 NICUs, Hierarchical culture was the dominant culture in 35 units and Group culture was dominant in 5 units (Table 2). Figure 1 shows the organizational culture profile of all 40 units. Hierarchical was stronger than other culture types. With regard to the culture archetypes of physicians by units, 23 units had a higher emphasis on Group and Hierarchical, 12 units had a higher emphasis on Group, 4 units had a higher emphasis on Hierarchical and 1 unit had a higher emphasis on Rational and Hierarchical. The smaller units with mostly less than 10 respondents had wide CIs. For example, the highest gmean fell within the range of the other dimensions, or the minimum score of one dimension was close to the maximum score of another dimension. Therefore, more than one dominant culture was present in those small units. This was not the case among total units and nurses because of the large number of respondents. Figure 2 shows the organizational culture profile for the total physician sample. Group (gmean = 34.6) and Hierarchical (gmean = 31.7) archetypes were both higher than Developmental (gmean = 16.3) and Rational (gmean = 17.4). In terms of nurses' organizational culture, 34 units placed a higher emphasis on Hierarchical, 5 units had a higher emphasis on Group and 1 unit had a higher emphasis on Developmental. Figure 3 shows the organizational culture profile for the total nurse sample. Hierarchical (gmean = 36.3) was the highest, followed by Group (gmean = 25.8), Developmental (gmean = 16.3) and Rational (gmean = 21.7).

Table 2 Culture archetype means, 95% CI in units (total)

Unit	Hospital types	No. of beds	No. of staff (respondents)	Culture archetypes							
				Group		Developmental		Rational		Hierarchical	
				Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Overall (40 units)			1758	27.1	26.3–27.9	16.4	15.9–16.8	21.0	20.4–21.5	**35.5**	**34.6–36.4**
1	3	12	33	27.0	20.5–34.9	14.0	11.1–16.7	18.4	15.5–21.8	**40.5**	**32.4–48.9**
2	5	9	45	27.4	22.6–33.2	14.0	11.0–17.1	19.7	17.1–22.9	**38.9**	**32.7–45.3**
3	4	30	80	23.9	21.1–27.0	20.4	18.2–22.3	22.3	19.9–24.4	**33.4**	**29.8–37.1**
4	3	9	37	26.1	22.2–30.3	16.0	13.6–18.8	19.9	17.7–21.9	**37.9**	**33.4–43.0**
5	4	12	49	19.4	15.8–23.6	12.6	10.1–15.3	19.8	16.6–22.8	**48.2**	**42.1–54.4**
6	2	21	70	20.3	16.8–24.0	13.9	11.3–16.5	22.2	19.5–25.8	**43.6**	**38.0–49.3**
7	4	6	26	28.2	23.7–33.5	19.5	16.2–23.0	22.1	19.2–25.9	**30.1**	**25.9–35.4**
8	5	9	25	22.8	17.8–28.8	14.6	11.1–18.9	16.7	12.3–20.3	**46.0**	**37.6–54.8**
9	3	12	44	27.7	22.8–32.7	15.8	13.3–18.5	21.4	18.1–24.7	**35.1**	**29.8–40.8**
10	2	24	45	31.0	26.5–35.4	16.9	14.3–19.5	20.6	17.9–23.7	**31.4**	**26.9–36.2**
11	1	9	38	**31.9**	**27.6–36.3**	17.0	14.4–20.1	20.6	18.3–22.8	30.5	26.3–35.2
12	2	9	37	26.3	21.7–31.3	16.8	14.0–19.5	22.5	19.1–26.0	**34.4**	**29.2–40.1**
13	3	9	44	28.7	24.1–33.4	16.3	13.9–19.1	19.8	17.1–22.3	**35.2**	**30.0–40.7**
14	3	12	43	25.8	22.3–29.5	16.9	14.7–19.7	21.2	18.5–24.0	**36.1**	**32.0–40.7**
15	3	11	35	25.4	19.6–32.4	12.9	9.7–16.6	22.4	18.1–27.4	**39.4**	**32.3–47.1**
16	2	12	48	26.4	21.9–31.5	16.4	13.5–19.4	20.9	17.6–23.8	**36.3**	**30.3–42.3**
17	4	21	65	28.1	24.4–32.2	19.5	16.9–22.6	22.0	19.0–24.9	**30.4**	**26.9–34.6**
18	2	15	42	28.3	23.7–34.0	18.3	15.1–21.4	20.8	17.4–24.0	**32.6**	**27.1–38.6**
19	2	6	24	24.8	19.7–30.8	15.0	11.4–18.8	19.9	15.8–24.1	**40.3**	**33.2–47.5**
20	5	15	63	23.5	19.5–27.8	16.1	13.6–19.1	20.0	17.5–22.5	**40.5**	**35.3–46.0**
21	5	12	36	25.6	21.3–30.4	17.0	13.9–20.2	21.1	17.1–24.7	**36.3**	**30.8–41.5**
22	2	12	43	25.5	22.1–29.1	17.2	14.7–19.7	22.8	19.8–25.8	**34.6**	**30.4–38.9**
23	5	9	27	28.9	23.6–34.4	17.1	14.1–20.9	20.2	17.2–24.0	**33.8**	**28.4–40.0**
24	4	9	21	**37.6**	**31.9–43.4**	20.9	17.5–24.0	17.8	15.0–21.2	23.8	19.8–28.3
25	3	18	76	30.2	26.5–34.0	17.5	15.4–19.8	19.5	17.4–22.0	**32.8**	28.9–36.9
26	4	21	72	**29.5**	**26.1–33.1**	22.4	20.1–24.9	23.3	20.5–26.2	24.8	21.6–28.0
27	4	18	49	30.6	25.8–35.3	17.8	15.2–20.5	19.9	16.8–23.1	**31.7**	**27.1–36.8**
28	3	6	31	31.0	25.5–37.2	15.8	13.1–19.2	18.1	15.0–21.5	**35.0**	**28.2–42.1**
29	4	12	36	**29.0**	**23.4–35.1**	21.1	17.8–24.7	23.3	19.9–27.6	26.7	21.9–32.2
30	5	6	35	**33.7**	**30.3–37.3**	19.4	17.0–21.9	21.5	19.0–23.9	25.4	22.5–28.5
31	3	9	26	30.8	25.6–36.3	15.5	12.6–18.8	20.4	17.6–24.1	**33.3**	**27.7–38.9**
32	2	12	37	27.7	23.3–32.9	16.4	13.1–19.9	22.3	18.0–26.1	**33.7**	**27.9–40.0**
33	4	21	54	25.7	22.1–29.7	21.7	19.0–24.4	25.4	22.2–28.5	27.3	23.6–31.5
34	2	18	65	22.3	18.7–26.3	16.1	13.3–18.8	25.3	22.–28.7	**36.3**	**31.6–41.2**
35	3	9	43	21.0	17.1–25.5	12.4	9.6–15.3	22.3	19.3–25.2	**44.3**	**37.6–51.6**
36	3	9	43	31.4	25.9–37.5	16.6	13.7–19.5	19.2	16.0–23.0	**32.8**	**27.0–39.2**
37	3	9	38	23.3	19.2–27.7	16.5	13.–19.9	22.4	19.4–25.5	**37.8**	**32.8–43.7**
38	4	12	47	30.0	26.3–34.3	18.8	16.6–21.1	20.9	18.0–23.7	**30.3**	**26.2–34.2**
39	2	9	30	27.1	23.1–31.3	18.5	15.4–21.9	24.0	21.0–27.5	**30.4**	**26.3–34.9**
40	3	15	56	27.9	24.9–30.9	17.7	15.7–19.9	21.8	19.8–23.7	**32.6**	**29.7–35.8**

1: Red Cross hospitals, 2: University hospitals, 3: Private hospitals, 4: Public hospitals, 5: National hospitals.

Mean: closed part-wise geometric means, 95 % CI: 95 % bootstrap confidence envelopes.

Bold values indicate the highest culture archetypes in each hospital.

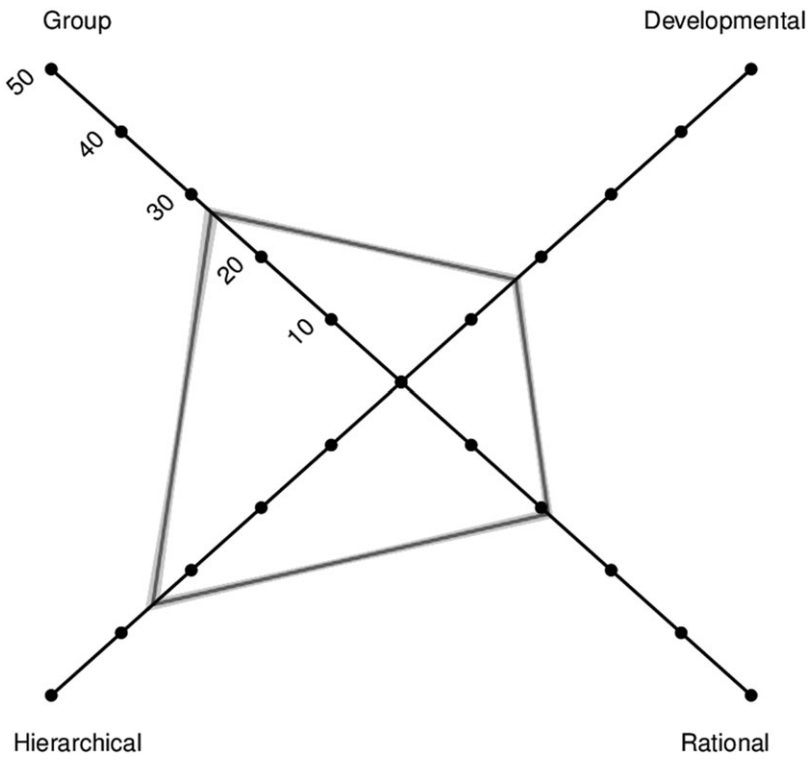

Figure 1 Organizational culture profile for total sample ($N = 1758$); closed part-wise geometric means and 95% bootstrap confidence envelopes.

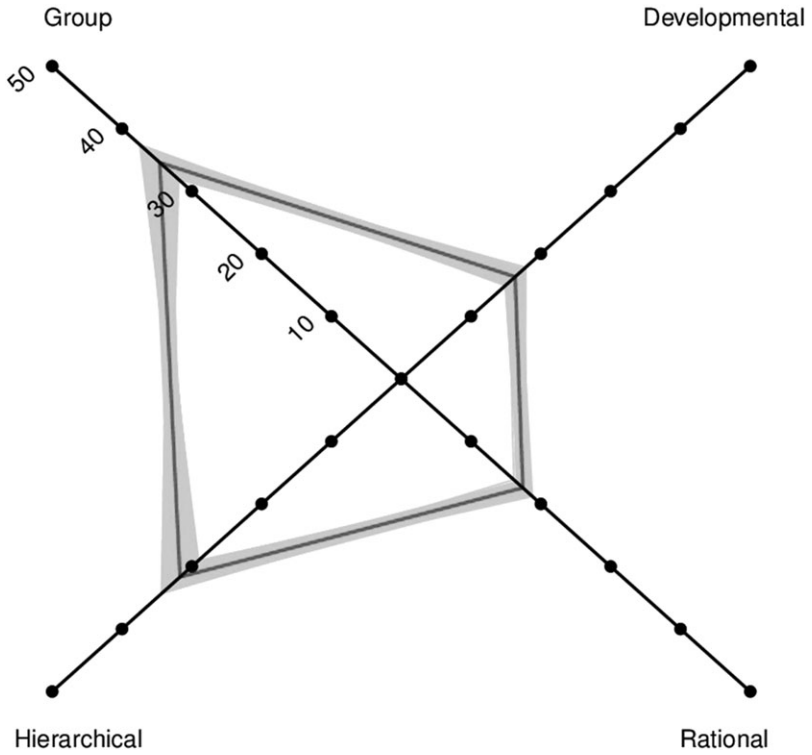

Figure 2 Organizational culture profile for total physician sample ($N = 289$); closed part-wise geometric means and 95% bootstrap confidence envelopes.

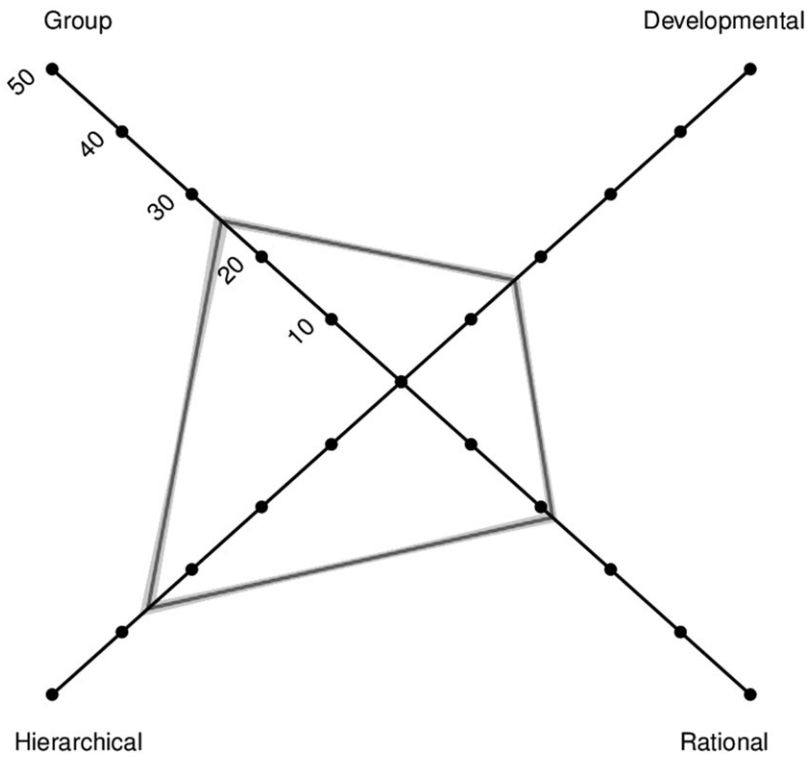

Figure 3 Organizational culture profile for total nurse sample ($N = 1469$); closed part-wise geometric means and 95% bootstrap confidence envelopes.

Association between culture archetypes and organizational/individual factors

Units with a dominant Hierarchical culture had a slightly higher median number of physicians (median = 7, minimum = 4, max = 14) than dominant Group culture (median = 6, minimum = 3, max = 12) among physicians. Units with a dominant Group culture had a higher median number of beds (median = 12, minimum = 6, max = 21) than dominant Hierarchical culture (median = 9, minimum = 6, max = 30). There were no differences in work hours per week (Group median = 70.9, Hierarchical median = 71.0) and work engagement (Group median = 3.4, Hierarchical median = 3.3). Among units with dominant Hierarchical culture among nurses, public hospitals had a higher number of nursing staff (median = 40.5, minimum = 21, max = 68) than other hospitals (university hospitals: median = 37.0, minimum = 18, max = 61; private hospitals: median = 36.0, minimum = 21, max = 65; national hospitals: median = 30.0, minimum = 21, max = 57). Nurses' work engagement was slightly higher in units with dominant Group culture (median = 2.8, minimum = 2.5, max = 3.3) than units with dominant Hierarchical culture (median = 2.6, minimum = 2.1, max = 3.0). There was no difference in the number of beds depending on dominant culture archetypes (Group: median = 12, minimum = 6, max = 24, Hierarchical: median = 12, minimum = 6, max = 30).

Discussion

This is the first study to assess organizational cultures in a large number of NICUs in Japan. We analyzed ipsative data of the CVF by taking into account its nature. Our findings revealed that dominant culture varied according to occupation. Group and Hierarchical cultures were both strong among physicians, while Hierarchical culture was stronger among nurses. The high Hierarchical culture scores had a positive association with the number of physicians. Nurses were likely to experience greater work engagement when working in units that emphasized Group values.

Physicians identified strongly with cultures emphasizing cohesiveness (group) and rules (hierarchical), which is partially consistent with previous findings that showed Canadian physicians working in NICUs gave their units a significantly higher hierarchical culture score. Mahl et. al argued that this can be explained by the uniquely specialized setting of the level III NICU, which manages the care of extremely premature or critically ill babies and so is generally a more protocol-focused setting with standardization of practice (Hierarchical) [23]. Teamwork is also highly important in life-threatening and time-critical situations such as the NICU, where a team requires clear communication and collaborative actions to avoid needless morbidity and mortality [42, 43]. This feature is clearly related to the other dominant culture (Group) of physicians.

Previous research in adult patients reported that points were equally distributed to four culture archetypes when assessing nurse culture in medical/surgical units [44]. In a survey on nursing staff of 11 dementia units in 11 Dutch nursing homes, 56% of nursing staff scored highest on Group culture, 28% scored highest on Hierarchical, 9% scored highest on Developmental and 7% scored highest on Rational culture [45]. In contrast, we found that nurses placed high value on Hierarchical culture. This result is most likely due to the characteristics of hospital nurses belonging to a nursing department. Nursing departments, particularly in Japan, expect nurses to carry out various management roles, which differ from other departments where nursing activities take place [46]. In addition, group size may influence culture. One report showed that large hospitals with subspecialty services tended to be more hierarchical than smaller hospitals [47].

In this study, Hierarchical culture was dominant in most units overall. This result may be influenced by the high value that nurses

place on this culture archetype, yet this is inconsistent with Canadian surveys in which 34 NICUs placed a higher emphasis on Developmental culture [48]. Regarding the association between Group culture and work engagement in nurses, a collaborative work environment of trust and unity might have influenced their motivation. This is consistent with previous findings that group culture values are positively related to job involvement and job satisfaction [4, 24]. On the other hand, according to Shimazu [33], work engagement and burnout may be considered opposite in the sense that they represent a positive (work engagement) and a negative (burnout) aspect of health-related well-being. If work engagement is assumed to be negatively related to burnout, nurses working in units with dominant Hierarchical culture may be more likely to burnout. It is important to take into account individual factors from both positive and negative aspects to explore the implementation of quality management and activities in different culture types.

There are few limitations in this study. The generalizability of our findings is unknown since we studied only NICUs that participated in the randomized controlled trial. Additionally, although the instrument has been adopted to measure culture in healthcare organizations, it has not been confirmed whether the dimensions are relevant to the Japanese context until it is examined qualitatively how health professionals perceive their organization.

Nonetheless, our results demonstrated a variation in perceived values across different units and occupations. It has been suggested that allowance must be made among professional groups such as nurses or physicians for the co-existence of multiple and heterogeneous values inside health organizations [49]. The inconsistency of cultural perceptions among different occupations has been observed in previous research on safety culture in Japan [50]. Although members in an organization belong to the same team, it is important to collect data from all members, and to understand the similarity and difference of cultures by positions or occupations. The importance of variety of respondents has also been suggested by authors, who concluded that the type of organizational culture was not associated with the development of quality management in a multi-country survey that measured organizational culture among only senior managers in European hospitals [51]. Identifying the strengths and weaknesses of organizational culture before initiating quality of care in practice is particularly useful for managers who struggle to improve patient outcomes. Otherwise, the implementations may become counterproductive. Strategy implementation for improving quality of care must differ by the type of organizational culture.

Conclusion

Our findings showed that organizational culture in NICUs varies depending on occupational group and team size. Group and Hierarchical cultures predominate among physicians, while Hierarchical culture is dominant among nurses. Units with strong cohesion and a participatory environment seem to achieve greater work engagement among nurses. Assessing organizational culture will provide insights into quality improvement strategies in healthcare.

Authors' contributions

H.S. administered the survey, acquired the data, performed the statistical analysis and prepared the draft. N.Y. provided supervision of the study design, the data analysis and interpretation. R.M. supervised the design of the study. T.Ni. and S.K. managed the whole research processes. T.Na. supervised the data analysis and critically revised the manuscript for important intellectual content. All authors were involved in critical commentary and approved the final version of the manuscript.

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