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2. სტატიის მოცულობა არ უნდა შედგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიისა და რეზიუმების (ინგლისურ,რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენ-ტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ,რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი,მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემა-ჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტო-სურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი,ანათლების შედებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სუ-რათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხო-ური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიდრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი,წელი,ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიდრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანე-ლის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა,მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა,რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შე-ჯერება ხდება სააეტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

Содержание:

INTER-PROFESSIONAL 360-DEGREE EVALUATION OF THE PERFORMANCE OF INTENSIVE CARE UNIT NURSES

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Abstract.

Purpose: A 360-degree evaluation is an objective evaluation method for people to be surveyed by evaluators from various positions and perspectives. The purpose of this study to create an objective method of 'comprehensive' verification of the entire survey using Spearman rank correlation coefficient and Wilcoxon signed rank test.

Methods: With these statistical methods, a detailed correlation and comparison between the self-evaluation of intensive care unit nurses and their evaluation by staff of other medical occupations could be assessed.

Results: Detailed correlations and differences were clarified for each survey item and surveyees. By a scoring method that takes into account the correlation and comparison results of the evaluation scores in evaluators and surveyees, and the total evaluation scores were visualized as radar charts.

Conclusions: Our results could highlight agreement and discrepancies between the evaluations performed by the surveyees and those by the evaluators. This time, the survey was conducted with a small number of surveyors, surveyees, and survey items, but the possibility of responding to a larger scale survey was indicated. It might be meaningful to make full use of statistical methods to comprehensively evaluate the overall survey results and clearly show them in visual methods such as radar charts.

Key words. Inter-professional, 360-degree evaluation, intensive care unit, nurses.

Introduction.

A 360-degree evaluation is an objective evaluation method for people to be surveyed by evaluators from various positions and perspectives [1,2]. There are no requirements regarding the number of evaluated persons, evaluators, or question items. As such, the scale of a survey can be determined as needed. This evaluation method can be useful in developing the ability of evaluators [1,2], while also helping to discover and resolve issues faced by those being surveyed [1,2]. Evaluations tied to promotion and salary are not appropriate, but it may be possible to supplement the supervisor's observations with evaluations from other associated occupational staff [1,2].

Skills and knowledge are required in the medical workplace, like other workplaces, but it also requires consideration and compassion for patients and their families. These abilities are particularly necessary in intensive care unit (ICU) nurses, who treat patients with severe and acute changes. As with many other occupations, departmental aptitude evaluations, performance evaluations and evaluations aimed at improving skills are often performed [3,4]. An evaluation that is more objective and more

multifaceted is desired, which, in recent years, has commonly led to a 360-degree evaluation by multidisciplinary staff being performed [1-5]. Previous studies of 360-degree evaluation have focused on the evaluators, as well as professional staff (such as doctors, nurses, and pharmacists), patients and patient families who have cooperated [6]. Alternatively, the studies have been surveys of residents, medical students, nurses and nursing students, or they have been studies of 360-degree evaluation of medical residents, medical students, nurses and nursing students [7-11]. To our knowledge however, there has not been any report on the 360-degree evaluation of ICU nurses by multidisciplinary staff.

The purpose of this study was to create an objective method of 'comprehensive' verification of the entire survey, based on statistical methods, the Spearman rank correlation coefficient and the Wilcoxon signed rank test. We used these tests to perform a detailed investigation of the correlation and comparison between the self-assessment of ICU nurses and their assessment by other healthcare professionals, identifying agreement and discrepancy between the data sources.

Materials and methods.

Survey: Survey items were prepared with reference to previous 360-degree evaluation surveys. Considering the number of items that could be reasonably completed in about 15 minutes, the number of survey items was set to 20 (see Table 1) and set by considering previously published studies. The items were classified into four categories as shown in Table 1. Each item was scored from a grade of 1 (lowest score) to 5 (highest score).

In 360-degree evaluation, there is no rule around the number of participating surveyees or evaluators. This type of evaluation had been performed at our facility for several years, and surveyees and evaluators were arbitrarily selected from staff who were familiar to this evaluation. Twenty-one ICU nurses were randomly selected for the study. The evaluator randomly selected three medical doctors, eighteen nurse colleagues, three nurse supervisors and four associated medical staff working in the ICU (pharmacists, physical therapists). The focus of this survey were ICU nurses at our hospital. The survey analysis was conducted in August 2022. The questionnaire was answered anonymously.

The evaluation of the four categories of the 20 items (Table 1) was scored in consideration of statistically significant differences in correlation and comparison of evaluators and surveyees, and the evaluation results for each evaluator were represented as a radar chart. Statistical difference among the total points of the four categories evaluators were compared. Using the same method, the evaluation results for each surveyee were shown in a radar chart.

Table 1. Items investigated in the questionnaire.

Number			category
1	Understanding own strengths, weaknesses, and limitations: through own patient care	Individual characteristics	
2	Studying to improve every day	Individual characteristics	
3	Can accept the suffering and joy of others	Individual characteristics	1
4	No selfish words and deeds	Individual characteristics	
5	Responding to the needs of patients in detail without prioritizing their own convenience	Individual characteristics	
6	Clean clothes and always be aware of others	Interpersonal ability	
7	Being able to treat with correct language and a calm attitude	Interpersonal ability	
8	Listening to patients and treat them with compassion	Interpersonal ability	2
9	Showing empathy, honesty and respect for others	Interpersonal ability	
10	Explaining to patients and their families in an easy-to-understand manner	Interpersonal ability	
11	Compassionate and effective care for patients	Knowledge technology	
12	Educating patients, families, juniors, students	Knowledge technology	
13	Communicating properly with patients and their families	Knowledge technology	3
14	Being able to carry out work as a medical professional with due consideration for maintaining the privacy of patients	Knowledge technology	
15	Have sufficient nursing expertise according to the grade after graduation	Knowledge technology	
16	Communicating appropriately with doctors, nurses and medical staff	Team approach to health care	
17	Working properly as a member of medical team care	Team approach to health care	
18	Keeping relationships with medical care smooth and getting along with everyone	Team approach to health care	4
19	Willing to help others in their work	Team approach to health care	
20	Being aware of being an organization person and strive to improve teamwork with those around you	Team approach to health care	

Statistical analyses: In this study, we used two nonparametric statistical tests to correlate and compare the evaluation by ICU nurses with that by the evaluators, for each survey item and each individual ICU nurse. First, for each survey item, we evaluated the correlation between the self-scoring of the ICU nurse who was the subject of the survey with the score of the other evaluators using the Spearman rank correlation coefficient. Next, these corresponding scores were evaluated using the Wilcoxon signed rank test to determine which one had the higher score. $P < 0.05$ was considered a statistically significant difference. If there was a significant correlation between the self-scoring evaluation by surveyees with that by evaluators, and a significant difference was obtained between these evaluations, this was classified as having 'agreement'.

Results.

Background of subjects: The subjects of the survey were 21 ICU nurses, with 3-8 years of experience as nurses. The other medical professions (evaluators) who evaluated the ICU nurses were as follows: three nurse supervisors (15 years or more of experience as a nurse), three doctors working in the ICU, (3-25 years of experience as a doctor), 18 nurse colleagues working in the ICU (1-13 years of experience as a nurse), and four associated medical staff (one pharmacist, one clinical engineer, and two physical therapists, with 2-18 years as professional medical staff). All evaluators had a history of working together with the ICU nurses for more than six months in the ICU.

Analysis of each survey item: The results are shown in Table 2. Some items could not be calculated due to lack of data, but 19 of the 20 survey items could be evaluated. When correlating and comparing the evaluation of medical doctors with the evaluation of ICU nurses, a significant correlation and a significant difference in comparison was found in four items. In two of the four items, we found a positive correlation and higher evaluation by medical doctors than by ICU nurses. In the remaining two items, a negative correlation and higher evaluation by medical doctors than by ICU nurses was found. Analysis of the correlation and comparison between nurse supervisors and ICU nurses found a positive correlation and lower evaluation by supervisors than by ICU nurses for one item, and a negative correlation and higher evaluation by supervisors than by ICU nurses also for one item. The analysis between nurse colleagues and ICU nurses found a positive correlation and lower evaluation by nurse colleagues than by ICU nurses in three items, and a negative correlation and higher evaluation by nurse colleagues than by ICU nurses in one item. Analysis between the associated medical staff and ICU nurses found a positive correlation and higher evaluation by the associated medical staff than by ICU nurses in five items, and a negative correlation and higher evaluation by the associated medical staff than by ICU nurses in one item.

Overall, in seven items there was a positive correlation between the evaluation of the surveyees and that of the evaluators, with the latter significantly higher than the former. It is considered that these items were evaluated as exceeding the evaluator's expectations. None of these were from the evaluations of supervisors or colleagues. On the contrary, in four items there was a positive correlation between surveyees and evaluators where the former was significantly higher than the latter. And in one item, there was a negative correlation between surveyees

Table 2. *Results of the correlation and comparison between the evaluation of each questionnaire item and that of medical staff in intensive care unit.*

Questionnaire item number	Medical doctors	Nurse supervisors	Nurse colleagues	Associated medical staff	category
1. Understanding the limits	r=0.405 P=0.705	r=0.076 P=0.744	r=0.407 P=0.067	r=-0.36 P=0.109	
	N=O P=0.069	N<O P=0.001	N<O P=0.001	N<O P=0.001	
2. Spirit of improvement	r=-0.14 P=0.544	r=-0.75 P=0.74	r=0.367 P=0.102	r=0.261 P=0.253	
	N<O P=0.001	N<O P=0.014	N<O P=0.008	N<O P=0.001	
3. Ability to accept	calculation not possible	r=-0.194 P=0.400	r=-0.462 P=0.035	r=-0.03 P=0.896	
	N<O P=0.001	N<O P=0.001	N<O P=0.001	N<O P=0.001	1
4. Unselfish words and actions	calculation not possible	r=-0.336 P=0.136	r=-0.362 P=0.107	r=0.917 P=0.001	
	calculation not possible	N<O P=0.001	N<O P=0.001	N<O P=0.001	
5. Delicate response ability	r=-0.528 P=0.014	r=0.073 P=0.753	r=0.783 P=0.00	r=0.034 P=0.883	
	N<O P=0.001	N>O P=0.001	N>O P=0.004	N<O P=0.001	
6. Behavior that is conscious of others	calculation not possible	r=-0.336 P=0.136	r=-0.362 P=0.107	r=0.917 P=0.001	
	calculation not possible	N<O P=0.001	N<O P=0.001	N<O P=0.001	
7. Calm attitude	calculation not possible	r=-0.391 P=0.080	r=-0.141 P=0.543	r=-0.034 P=0.883	
	calculation not possible	N<O P=0.001	N<O P=0.001	N<O P=0.001	
8.Ability to listen closely	calculation not possible	r=-0.34 P=0.131	r=-0.370 P=0.098	r=0.422 P=0.056	2
	calculation not possible	N<O P=0.001	N<O P=0.001	N<O P=0.001	
9. Honesty	r=0.27 P=0.001	r=-0.152 P=0.001	r=-0.202 P=0.001	r=-0.5 P=0.001	
	N<O P=0.236	N<O P=0.509	N<O P=0.381	N<O P=0.560	
10. Easy-to-understand explanation	calculation not possible	calculation not possible	calculation not possible	calculation not possible	
	calculation not possible	calculation not possible	calculation not possible	calculation not possible	
11. Compassion	r=0.455 P=0.038	calculation not possible	r=0.427 P=0.054	r=-0.509 P=0.019	
	N=O P=0.202	calculation not possible	N>O P=0.054	N<O P=0.001	
12. Education of others	r=0.514 P=0.017	r=0.391 P=0.080	r=0.425 P=0.009	r=-0.355 P=0.115	
	N<O P=0.100	N<O P=0.001	N>O P=0.001	N<O P=0.001	3
13. Communicate with patients	r=0.195 P=0.396	r=0.392 P=0.079	r=0.092 P=0.692	r=0.029 P=0.902	
	N<O P=0.001	N<O P=0.001	N<O P=0.001	N<O P=0.001	
14. Performing duties of medical personnel	r=-0.256 P=0.263	r=0.082 P=0.725	r=-0.001 P=1.000	r=0.523 P=0.015	
	N<O P=0.001	N<O P=0.001	N<O P=0000	N<O P=0.001	
15. Knowledge / skills	r=0.244 P=0.287	r=0.694 P=0.001	r=0.554 P=0.009	r=0.455 P=0.038	
	N<O P=0.705	N>O P=0.001	N>O P=0.001	N<O P=0.001	
16. Communication with staff	r=-0.396 P=0.076	r=-0.476 P=0.029	r=0.041 P=0.861	r=0.622 P=0.003	
	N<O P=0.001	N<O P=0.001	N<O P=0.001	N<O P=0.001	
17. Work processing capacity	r=0.461 P=0.035	r=0.134 P=0.563	r=0.241 P=0.293	r=-0.422 P=0.056	
	N<O P=0.001	N>O P=0.001	N>O P=0.001	N<O P=0.001	
18. Good relationship with others	r=-0.544 P=0.011	r=-0.266 P=0.244	r=0.01 P=0.965	r=0.216 P=0.347	4
	N<O P=0.001	N<O P=0.001	N<O P=0.001	N<O P=0.001	
19. Helping others	r=-0.012 P=0.959	r=-0.203 P=0.378	r=0.187 P=0.417	r=0.131 P=0.570	
	N<O P=0.829	N>O P=0.001	N>O P=0.001	N<O P=0.001	
20. Contribution to teamwork	r=-0.042 P=0.856	r=0.317 P=0.161	r=0.113 P=0.627	r=0.156 P=0.500	
	N<O P=0.001	N<O P=0.001	N<O P=0.001	N<O P=0000	

Table 3. *Results of the correlation and comparison between the evaluation of each nurse and that of medical staff in intensive care unit.*

Nurse number	Medical doctors		Nurse supervisors		Nurse colleagues		Other medical staff	
1	r=0.545	P=0.016	r=0.506	P=0.027	r=0.562	P=0.012	r=0.343	P=0.150
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
2	r=0.095	P=0.698	r=0.084	P=0.733	r=0.463	P=0.046	r=0.636	P=0.003
	N<O	P=0000	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
3	r=-0.105	P=0.67	r=-0.548	P=0.015	r=0.054	P=0.827	r=0.291	P=0.226
	N<O	P=0000	N<O	P=0.001	N<O	P=0.029	N<O	P=0.001
4	r=0.377	P=0.154	r=0.3	P=0.212	r=0.571	P=0.01	r=0.623	P=0.004
	N<O	P=0.001	N>O	P=0.001	N<O	P=0.008	N<O	P=0.001
5	r=0.403	P=0.087	r=-0.171	P=0.483	r=-0.12	P=0.624	r=0.077	P=0.754
	N<O	P=0.001	N<O	P=0.483	N<O	P=0.466	N<O	P=0.001
6	r=0.032	P=0.897	r=0.349	P=0.143	r=0.465	P=0.045	r=0.266	P=0.271
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
7	r=0.237	P=0.328	r=0.185	P=0.449	r=0.165	P=0.500	r=0.445	P=0.056
	N<O	P=0.004	N>O	P=0.001	N>O	P=0005	N<O	P=0.001
8	r=0.341	P=0.153	r=0.19	P=0.436	r=0.191	P=0.433	r=0.536	P=0.018
	N<O	P=0.005	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
9	r=-0.257	P=0.288	r=-0.18	P=0.46	r=-0.04	P=0.872	r=0.522	P=0.022
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
10	r=-0.012	P=0.961	r=-0.521	P=0.022	r=-0.221	P=0.362	r=-0.023	P=0.925
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
11	r=-0.43	P=0.066	r=0.001	P=0.999	r=0.464	P=0.046	r=0.686	P=0.001
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
12	r=-0.105	P=0.668	r=0.001	P=0.999	r=-0.136	P=0.577	r=0.395	P=0.094
	N<O	P=0.001	N<O	P=0.004	N<O	P=0000	N<O	P=0.001
13	r=-0.167	P=0.494	r=0.359	P=0.131	r=-0.286	P=0.235	r=0.143	P=0.559
	N<O	P=0.001	N>O	P=0.007	N<O	P=0.001	N<O	P=0.001
14	r=-0.077	P=0.754	r=0.168	P=0.491	r=0.4	P=0.871	r=0.098	P=0.691
	N<O	P=0.001	N>O	P=0.054	N<O	P=0001	N<O	P=0.001
15	r=0.16	P=0.947	r=0.027	P=0.914	r=0.321	P=0.18	r=0.154	P=0.529
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
16	r=0.056	P=0.82	r=0.283	P=0.24	r=0.212	P=0.383	r=0.068	P=0.781
	N<O	P=0.001	N<O	P=0000	N<O	P=0.092	N<O	P=0.001
17	r=-0.143	P=0.559	r=0.243	P=0.317	r=0.067	P=0.785	r=0.277	P=0.251
	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001	N<O	P=0.001
18	r=0.515	P=0.02	r=0.164	P=0.49	r=0.343	P=0.138	r=0.285	P=0.224
	N<O	P=0.001	N<O	P=0.004	N>O	P=0.001	N<O	P=0.001
19	r=0.505	P=0.023	r=0.223	P=0.344	r=0.157	P=0.001	r=0.425	P=0.062
	N<O	P=0.001	N>O	P=0.008	N<O	P=0.004	N<O	P=0.001
20	r=0.267	P=0.256	r=0.422	P=0.064	r=0.654	P=0.002	r=0.292	P=0.212
	N<O	P=0000	N<O	P=0.001	N<O	P=0.008	N<O	P=0.001
21	r=0.144	P=0.545	r=0.177	P=0.456	r=0.523	P=0.18	r=0.228	P=0.334
	N<O	P=0.545	N<O	P=0.456	N<O	P=0.18	N<O	P=0.334

and evaluators where the latter was significantly higher than the former. It is considered that these items were evaluated as being below the expectations of the evaluators. All of these evaluations were from supervisors and colleagues.

Analysis of each ICU nurse: The results are shown in Table 3, where all items were assessable. The correlation and comparison between medical doctors and ICU nurses found a positive correlation and higher evaluation by medical doctors than by ICU nurses in three nurses. The correlation and comparison between nurse supervisors and ICU nurses found a positive correlation and higher evaluation by supervisors than by ICU nurses in one nurse. A negative correlation and higher evaluation by nurse supervisors than by ICU nurses were

found in two nurses. The correlation and comparison between nurse colleagues and ICU nurses found a positive correlation and higher evaluation by nurse colleagues than by ICU nurses in seven nurses. The correlation and comparison between the associated medical staff and ICU nurses found a positive correlation and higher evaluation by the associated medical staff than by ICU nurses in five nurses.

Overall, in 10 ICU nurses, there was a positive correlation between the evaluations of the surveyees with that of the evaluators, where the latter was significantly higher than the former; that is, we consider that these items exceeded the evaluator's expectations. On the contrary, in two nurses, there was a positive correlation between surveyees and that of the

evaluators where the former was significantly higher than the latter. It is considered these were evaluated to be below the expectations of the evaluators. All of these evaluations were from supervisors and colleagues.

Laser chart evaluation: Based on the statistically processed data in Table 2, we aggregated the total evaluation points for each evaluator group and created a radar chart of the four categories, which were consisted of 20 items (Table 1). At first, an evaluation point table (the maximum total score is 100 and the minimum score is -100) was created, taking into account the "statistically significant difference in correlation" and the "statistically significant difference in comparison of evaluation values" (Table 4). Next, based on this table, the results of total points for each surveyee were shown as a radar chart (Figure 1-A). There was a statistically significant difference among the total points of these four groups of evaluators (p=0.001, chi-square test). Similarly, based on the data in Table 3, a radar chart of total evaluation points for each surveyee was created and shown in Figure 1-B. Each surveyee's total evaluation points show variability. For example, there was a statistically significant difference among the scores of 21 surveyees (p=0.001, chi-square test).

Discussion.

In this study, a questionnaire surveyed 20 items in 21 ICU nurses with 28 other medical staff as evaluators. To assess the objectivity of the scores, we examined the correlation between the scores the ICU nurses gave themselves with that received by the other medical staff. Next, we compared the scores of ICU nurses with the scores of the other medical staff. If there was a significant correlation, we then evaluated the significance of the comparison. Score comparisons were conducted by focusing on each survey item, each ICU nurse, and each medical occupation. This statistical approach enabled us to highlight the agreements and discrepancies between the self-evaluations performed by the surveyees with those by the evaluators. Now that these statistical methods are established, it would be possible to easily scale up the survey items and number of staff. The Spearman rank correlation coefficient and Wilcoxon signed rank test, which were used in this study, ensured objectivity in examining the corresponding scores for each set. This study did not only obtain individual evaluations of each survey item and each surveyee. Our aim was to create an objective method of 'comprehensive' verification of the entire survey, based on statistical methods. It is understandable that some would argue that complex statistical processing is unnecessary if it is only for the purpose of 'evaluation of individual question items' and 'evaluation of individual surveyees'. However, we do believe that it is significant that we were able to comprehensively evaluate the entire survey results by making full use of statistical methods, and that it could be clearly shown visually in the form of a radar chart. In this study, the statistical processing supposed to take some time and effort, so we started by implementing

Table 4. *Evaluation point table that takes into the results of correlation and comparison between evalaluator's scoreanf surveyees'score.*

| Correlation		Comparison		Points for total point calculation
Correlation	statisical significance	Comparison	statisical significance	
positive	present	evaluator' score > surveyee's score	present	20
positive	present	evaluator' score > surveyee's score	not present	10
positive	present	evaluator' score = surveyee's score	present	0
positive	present	evaluator' score = surveyee's score	not present	0
positive	present	evaluator' score < surveyee's score	present	0
positive	present	evaluator' score < surveyee's score	not present	-10
positive	absent	evaluator' score > surveyee's score	present	10
positive	absent	evaluator' score > surveyee's score	not present	5
positive	absent	evaluator' score = surveyee's score	present	0
positive	absent	evaluator' score = surveyee's score	not present	0
positive	absent	evaluator' score < surveyee's score	present	0 (for inconsistent results)
positive	absent	evaluator' score < surveyee's score	not present	-5
negative	present	evaluator' score > surveyee's score	present	0 (for inconsistent results)
negative	present	evaluator' score > surveyee's score	not present	2.5
negative	present	evaluator' score = surveyee's score	present	0
negative	present	evaluator' score = surveyee's score	not present	0
negative	present	evaluator' score < surveyee's score	present	-20
negative	present	evaluator' score < surveyee's score	not present	-10
negative	absent	evaluator' score > surveyee's score	present	5
negative	absent	evaluator' score > surveyee's score	not present	2.5
negative	absent	evaluator' score = surveyee's score	present	0
negative	absent	evaluator' score = surveyee's score	not present	0
negative	absent	evaluator' score < surveyee's score	present	-5
negative	absent	evaluator' score < surveyee's score	not present	-2.5
incalculable	any	any	any	0
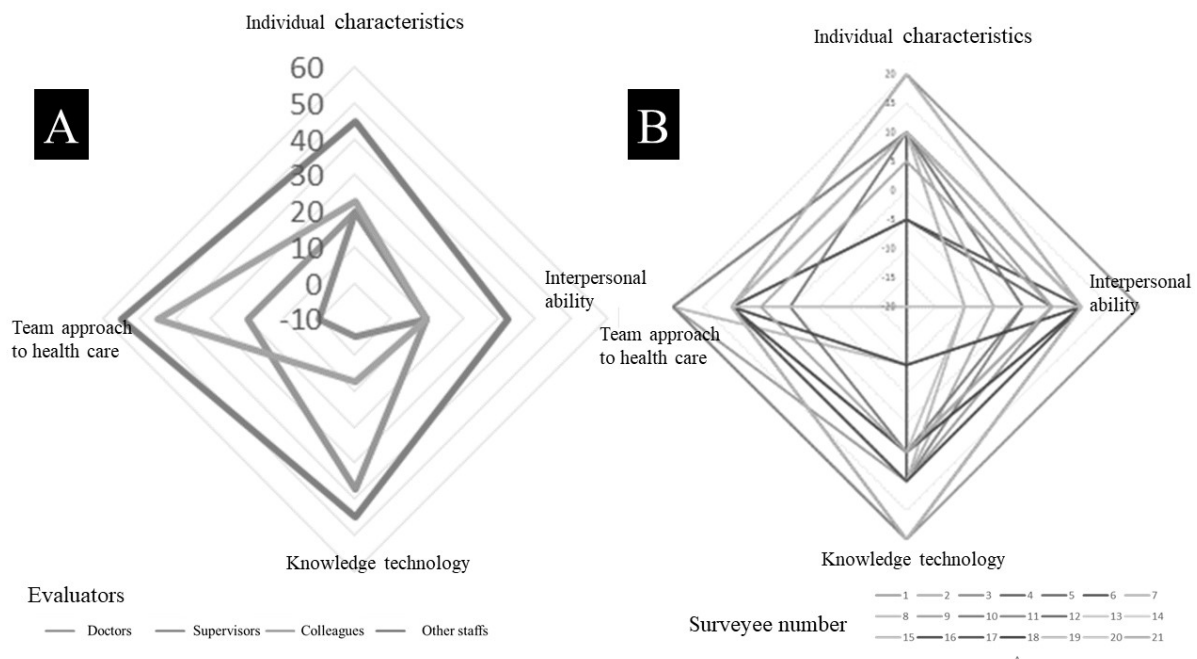
Figure.1. *Radar chart of 4 evaluator groups (A) and that of 21 nurse surveyees (B) according to the evaluation point table (Table 4).*

statistical processing on a limited scale. In this exploratory study, we conducted an analysis of ICU nursing staff as a small population. Not only did we obtain multidisciplinary evaluation information regarding the evaluation of ICU nurses, but we also demonstrated the possibility of conducting a survey using the same method even if the number of survey items and the number of survey subjects were increased.

Another method could be to investigate internal consistency using Cronbach's alpha (α) [12,13], which can evaluate overall internal consistency [12,13]. However, the statistical method used in this study was a new attempt to evaluate individual items and individuals, noting that it took time and effort to perform individual calculations.

Patients admitted to ICU have serious illnesses and often undergo sudden status changes. Therefore, ICU nurses are required to observe these patients with their understanding of pathological physiology [14]. This requires the ability to identify abnormalities at an early stage and respond quickly when an abnormality occurs. Another important role of ICU nurses is to support the daily lives of patients and respond to their needs [15]. ICU nurses provide assistance to patients and their families from multiple perspectives to provide them peace of mind without anxiety, such as relief of pain and anxiety, ethical conflicts, and assistance in decision-making [16]. Medical staff of other occupations, such as "doctors", "clinical engineers", and "pharmacists", may be assigned to the ICU for specialized work. As such, ICU nurses are also required to work effectively with these medical professionals. Thus, while working in an ICU can be an extremely difficult role, it is often evaluated as a very "rewarding" nursing job [17].

In the present research, some ICU nurses obtained both a positive correlation and higher scores. In such cases, it could be interpreted that the evaluation exceeded expectation, in which case, it might be necessary to convey "praising evaluation" as

positive feedback to the nurses themselves. On the other hand, despite a positive correlation, it is more difficult to deal with cases where the opposite scoring result occurs. We need to be careful about feedback of negative results that might be an issue related to evaluation by other medical staff [18,19]. This, however, is not the main point of this study and will not be discussed here.

The advantage of evaluation by other medical staff is that it evaluates from broad perspectives and is more likely to maintain objectivity. In the present study, evaluation was from a limited number of occupations, but it should be possible in theory to have evaluations from many more occupations. On the other hand, the disadvantage of this evaluation method might be that it is not possible to completely unify the scoring across the other medical staff. The solution to this might be to conduct a survey with as many evaluators as possible. Another disadvantage is that we need to be aware that the results obtained are a relative assessment of the magnitude of expectations. If expectations are too high, the score may be low, and the degree of expectations will affect the survey results [16]. For example, as has been reported in the past, evaluation by nurse supervisors tends to be strict due to the high expectations [19]. As such, a more objective evaluation might be achieved by considering the evaluation of other medical staff. This was observed in the current study when comparing scores between nurse supervisors and those of doctors and associated medical staff. So, it is possible that the magnitude of the expectation had an effect. To best use the 360-degree evaluation by other medical staff, evaluation should be from viewpoints, such as workplace soundness, proper staffing, promotion, and salary [20].

It is important to fully understand the characteristics of the survey itself before utilizing it. There have been several reports on the evaluation of medical and nursing students. This includes a study by Meghdad et al around choosing qualified nurses,

which used a method of weighting the scores based on Fuzzy theory that seemed statistically difficult and complicated [21]. In this study we used a combination of the Spearman's rank correlation coefficient and the Wilcoxon signed rank test. While the Spearman's rank correlation coefficient has been widely used, the combination of this method with the Wilcoxon signed rank test was novel.

In this study, we created an evaluation point table as shown in Table 4, taking into consideration "statistically significant difference in correlation" and "statistically significant difference in evaluation value comparison". It is possible to create a radar chart using the score table like this and assign point with any weighting. Therefore, in the method presented here, it is possible to arbitrarily weight and analyze the results obtained according to the purpose of evaluation, such as evaluation of individual items and comprehensive evaluation.

While there are some notable points to this research, there are also some limitations. The results could vary greatly depending on how the staff of other occupations were selected, and the optimal number of evaluators is not clear. In this study, evaluation was made based on a statistically significant correlation and significant score comparison results. However, if there was no significant correlation, or if there was no significant difference in scores between individual survey items and individual ICU nurses, it was considered a discrepancy. Also, if the results of the correlation and comparison were statistically inconsistent, they were not considered to be in agreement. It may be good to have an approach around how to effectively use these results. Furthermore, how to calculate the comprehensive evaluation of each survey item and each ICU nurse remains an issue. That is, in this survey, if more than a few of the 20 items were significant, the question was whether the overall rating should be "good". A challenge for the future is whether to statistically evaluate the assurance of objectivity and how to utilize this evaluation.

In this study, we performed a 360-degree evaluation of ICU nurses with other medical staff. It might be meaningful to make full use of statistical methods to comprehensively evaluate the overall survey results and clearly show them in visual methods such as radar charts. It is important we continue efforts to improve the accuracy and reliability of the 360-degree evaluation.

Authors' contributions.

TN, NK and HS contributed to the planning, conduct, reporting, conception, design, and acquisition of data and drafting the manuscript. All authors read and approved the final manuscript. NT and HS confirm the authenticity of all the raw data.

Ethics approval and consent to participate.

This study was approved by the Ethics Committee of our hospital as an ethical review (NO-22-32).

Competing interests.

The authors declare that they have no competing interests.

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