

Fact-finding survey on measurement of pupil diameter by clinical nurses in Japan

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Abstract

Aim: To explore the experiences of clinical nurses in Japan in measuring pupil diameter, their confidence in the results, and their experiences of using measuring instruments.

Methods: An original questionnaire about measuring pupil diameter was sent to a survey company in December 2022. The survey company had 6,197 nurses and assistant nurses registered, and they were all invited to participate. The survey company sent a questionnaire asking about work in clinical settings to potential respondents. We calculated descriptive statistics for each variable and examined associations between variables and self-reported confidence in results.

Results: Overall, 1,541 nurses responded to the online survey, a valid response rate of 24.9%. The respondents' average age was 47.4 years, and their average duration of clinical experience was 21.7 years. Overall, 54.7% of participants were nurses with experience in manual pupil diameter measurement, and over 50% of the nurses had taken manual pupil diameter measurements at least 100 times. Only 24 nurses had conducted instrumental measurements. No association was found between experience with instrumentation and bed size of facility. The average confidence in pupil diameter measurement was 3.56 on a six-point scale and the interquartile range was between "somewhat confident" and "somewhat not confident." However, 40% of respondents were either "somewhat not confident" or "not confident at all."

Conclusions: Only approximately half of the nurses had experience with pupillometry, and 40% lacked confidence in the results of pupil diameter measurements. We therefore recommend that using quantitative measurement tools that serve as accurate standards, and workshops be conducted to increase nurses' confidence.

Key words: nurse, pupil, survey

Introduction

The "Model Core Curriculum for Nursing Education in Japan" was presented by the Study Group on Nursing Human Resource Development at Universities in 2017. It sets out the core nursing practice competencies and achievement goals required at the time of graduation

from the bachelor's degree program. There are seven major items, and "D: Basic knowledge of specialization that forms the basis of nursing practice" requires nurses to demonstrate the knowledge and skills to meet the needs of the nursing targets (Study Group on Nursing Human Resource Development at Universities, 2017). One of the basic skills set as a learning goal is being able to conduct a physical assessment.

The purpose of a physical assessment is to evaluate someone's physical function using interviews, visual inspection, palpation, percussion, and auscultation. One of the assessments of the brain/nervous system is observation of the pupil/light reflex. This is part of the assessment of vital signs and is used only for high-risk patients with a suspected disorder of the brain or nervous system. Patients with oculomotor, optic, or brain stem disorders have decreased or absent

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reflexes. Observation of the pupil and light reflex is therefore a necessary skill for nurses working on the management of cranial nerve diseases such as cerebral hemorrhage and cerebral infarction (Ishihara et al., 2015) as well as those in critical care (Takehara, 2015), home-visit nursing (Yoshida et al., 2021), and end-of-life care (Watanabe, 2020). The physical assessment text describes how to observe pupils and light reflexes using a pupillometer and penlight. Pupil recorders, which are instruments used for quantitative measurements, have been introduced in other countries, but only a few studies have reported on their use in Japan (Izumi et al., 2014; Kobata, et al., 2015; Shiiba et al., 2019; Tsuyuki, 2019). All seven studies on pupil measurement in critically ill patients outside Japan used automated pupillometry to measure pupils (Nagata et al., 2021). Studies have also found that manual methods have a large margin of error in pupil diameter measurement and discrepancies in light reflex measurements (Meeker et al., 2005; Marshall et al., 2019). Abnormal pupillary transthoracic changes mean increased cerebral pressure, which, if not detected early, can endanger the patient's life. Instrumental measurements are also associated with better prognosis after cardiac arrest (Oddo et al., 2018) and with faster detection of changes in intracranial pressure (McNett et al., 2017; McNett et al., 2018; Giede-Jeppe et al., 2020). The Japan Resuscitation Council's (JRC) resuscitation guidelines 2020 ("JRC guidelines") recommend the use of quantitative instrumental measurement of pupil diameter at least 72 hours after return of spontaneous circulation (ROSC) in comatose adults when predicting neurological outcomes (Japan Resuscitation Council, 2021).

The first report on physical assessment education in basic nursing education in Japan was published approximately 25 years ago, in 1997 (Yokoyama & Nozaki, 1997). In practice, research on whether clinical nurses are accurately measuring pupil diameter in intensive care units (Izumi et al., 2014) and critical care centers (Kobata et al., 2015) is limited. The number and type of patients covered in these studies, such as patients with stroke, are also limited (Tsuyuki, 2019). A report on nurses working in public hospitals (Suzuki

and Endo, 2012) found that approximately 80% of nurses carried out light reflex and pupil measurements. This result suggests that pupil measurement is not a nursing skill required only in specific areas of practice.

To the best of our knowledge, no study has reported on how clinical nurses in Japan measure pupil diameter or on the proportion of measurements that use quantitative measurement instruments. There are also questions about the extent to which nurses are able to conduct pupil diameter measurements with confidence and accuracy in Japan. This study aimed to carry out a survey to establish the experience of clinical nurses working in Japan, their confidence in the results of measuring pupil diameter, and the extent to which instrumental measurements are recognized.

We believe that accurate measurement of pupil diameter and light reflexes is important because it leads to early detection of abnormalities that have a significant impact on the prognosis. It is therefore important to know about nurses' level of confidence in performing accurate measurements of pupil diameter.

Methods

Operational definition of terms

Pupil measurement: Pupil measurement in physical assessment includes the presence or absence of light reflexes and the measurement of pupil diameter (Abe, 2015). Studies from elsewhere have shown that manual measurements have large errors in pupil diameter measurement and discrepancies in light reflectance measurement by the examiner (Meeker et al., 2005; Marshall et al., 2019). We therefore decided to ask about measuring contrast light reflectance and pupil diameter.

Manual measurement: using pupillometer and penlight to observe the pupil and light reflex.

Instrumental measurement: using instruments such as NPi200 (<https://www.imimed.co.jp/medical/product/monitor/np200/>) to measure pupil diameter and light reflex.

Research design

This was an exploratory quantitative study. We carried out an online survey using a questionnaire

to investigate current pupil diameter measurement among clinical nurses in Japan, across diseases and patient settings.

Research period

The data collection period was December 9-12, 2022.

Data collection method

Previous studies have focused either on particular units (Izumi et al., 2014) or types of facility (Kobata et al., 2015), and involved only a limited number and type of patients (Tsuyuki, 2019). We felt that the field needed a comprehensive investigation of patient diseases and domains in which pupillometry is used. Individual requests for surveys among hospitals, long-term care facilities, and home care agencies would require an enormous amount of time. We therefore followed previous studies in using a survey company to obtain responses from a large number of participants (Morimoto and Inada, 2018). We obtained quotations from several survey companies and chose the company that had the largest number of nurses and assistant nurses in its panel.

At the time of the survey, the survey company had 6,197 nurses and assistant nurses registered, and they were all invited to participate.

The survey company was a privacy-marked certified company. It has acquired JISY20252 (ISO20252), which is a national standard and international standard for quality control of market research.

Questionnaire

We confirmed the respondents' gender, age, years of clinical experience, qualifications (nurse, assistant nurse, certified nurse, specialist nurse), and experience of measuring pupil diameter. Nurses with experience of measuring pupil diameter (including both manual and instrumental measurement methods) were asked about the following: (1) measurement method (natural light, use of penlight from front of eye, use of penlight from side of eye, or use of an instrument such as the NPi200); (2) total number of measurements undertaken; (3) their confidence in the measurement results (six-point scale from "extremely confident" to

"not confident at all"); (4) their experience when not confident in manual measurement results, including whether they referred to the measurement values of a previous worker, and the timing of the experience (for example, when a new employee, or immediately after moving departments or hospitals); (5) the clinical department where they measured pupil diameter; (6) the facilities and hospital sizes (number of beds) where they had experienced instrumental measurements; (7) whether they knew about the JRC resuscitation guidelines (2020) (nurses were deemed to have this knowledge if they were aware that using quantitative pupil diameter measurements after 72 hours following ROSC is recommended to predict neurological outcome in comatose adults); and (8) whether their confidence would change if they learned that manual measurements of pupil diameter have a large margin of error.

Analysis method

Raw data were received in an Excel file from the survey company. We calculated basic descriptive statistics for each variable. We then evaluated the presence or absence of pupil measurement experience by gender using the χ^2 test, and analyzed the relationship between nurses' clinical experience and confidence using Spearman's rank correlation coefficient. The nurses' self-reported confidence in manual pupil measurements was not normally distributed. For self-reported confidence for each variable and measurement result, we therefore used the Mann-Whitney U test to compare two groups, and the Kruskal-Wallis test to compare three groups or more. Data were analyzed using SPSS ver.22, and statistical significance was assessed at the .05 level.

Ethical considerations

Detailed personal information was not collected because we used an anonymous form based on an online survey. The survey company sent a questionnaire asking about work in clinical settings to potential respondents. An explanation of the research was presented before the participants answered the questionnaire. The explanation included the information

that participation was voluntary, that participants should confirm their consent before answering the questionnaire, that the data were anonymous, and that individuals could not be identified. It also noted that the participants could not withdraw consent later because the questionnaire was answered anonymously, and the responses were blinded. Those who read the survey description and agreed to participate completed the online questionnaire. We were sent the raw data with a password.

At the beginning of the questionnaire, the item “I understand the purpose of the research, so I will participate in the survey” was displayed, and respondents could only advance by placing a ☑ (checkmark) next to the statement. The raw data received from the survey company are not linked to personal information, and it was therefore difficult to identify individuals.

This study was conducted with the approval of the Ethics Review Committee of Kansai University of Social Welfare (No.4-1116) and in accordance with the principles of the Declaration of Helsinki.

Results

Profile of survey respondents

Table 1 summarizes the profile of the survey respondents. The survey was only open to those registered with the survey company, and details of non-responders are not available. Of the 6,197 nurses registered with the survey company, 1,541 responded to the questionnaire (effective response rate of 24.9%). There were 1,374 women (89.2%), 162 men (10.5%), and five ‘others’ (0.3%). The average age was 47.4 years (minimum-maximum range: 25-71 years), and the average clinical experience was 21 years and 8 months (minimum-maximum range: 5 months-50 years and 9 months). The respondents’ qualifications were as follows: 1,519 nurses (98.6%), 22 assistant nurses (1.4%), 32 certified nurses (2.1%), and 11 specialist nurses (0.7%).

Overall, 241 respondents (15.6%) knew that the JRC resuscitation guidelines suggest the use of quantitative pupil diameter measurements after 72 hours following ROSC to predict neurological outcomes in comatose adults. However, most of the nurses (1,300 nurses, 84.4%) were unaware of this (Table 1). Those with pupil diameter measurement experience showed significant levels ($p=0.035$) of knowledge of the JRC resuscitation guideline (Table 1). There were no significant

Table 1. Overview of survey respondents

					n=1,541	
		Total n=1,541 (%)	Pupil diameter measurement experience		p-value	Statistical method
			Present n=843 (%)	Absent n=698 (%)		
Sex	Female	1,374 (89.2)	741 (87.9)	633 (90.7)	.045	a
	Male	162 (10.5)	101 (12.0)	61 (8.7)		
	Other	5 (0.3)	1 (0.1)	4 (0.6)		
Age (years)	Average	47.4	46.4	48.7	.911	b
	Range	25-71	25-71	25-71		
Number of years of clinical experience (years)	Average	21.7	21.4	22.0	.291	b
	Range	0.4-50.8	0.4-50.3	2.0-50.8		
Acquired qualification	Nurse	1,519 (98.6)	835 (99.1)	684 (98.0)	.082	a
	Assistant nurse	22 (1.4)	8 (0.9)	14 (2.0)		
	Reposted					
	Certified nurse	32 (2.1)	22 (2.6)	10 (1.5)		
	Specialized nurse	11 (0.7)	3 (0.4)	8 (1.2)		
JRC guideline knowledge	Knew	241 (15.6)	147 (17.4)	94 (13.5)	.035	a
	Did not know	1,300 (84.4)	696 (82.6)	604 (86.5)		

a: χ^2 test b: Mann-Whitney U test
JRC: Japan Resuscitation Council

Table 2. Comparison by nurses' knowledge of JRC guidelines

n=1,541

JRC guideline	N (%)	Average age (years)	p-value	Average clinical experience	p-value*
Knew	241 (15.6)	47.5	.911	22.4 years	.291
Did not know	1,300 (84.4)	47.3		21.5 years	

* Mann-Whitney U test

JRC: Japan Resuscitation Council

Table 3. Nurses' level of confidence by experience of various methods of pupil diameter measurement

n=1,275

multiple answers possible

		n	Confidence	
			Average	Median
Pupil diameter measurement method	Measurement in natural light	256	3.67	4
	Penlight in front of the eye	536	3.58	4
	Penlight from the side of the eye	458	3.67	4
	Use of instrument such as NPi-200	24	n.d.	n.d.
	Other	1*	n.d.	n.d.

* use a fundus machine, n.d.: no information was requested about confidence level for instrumental measurement

differences between the two groups with and without knowledge of the guideline. Both had an average age of 47 years and 21-22 years of experience (Table 2).

Overall, 843 people had experience of measuring pupil diameter, of whom 835 were nurses, and eight were assistant nurses. We excluded the assistant nurses from our analysis because there are 1.32 million nurses in Japan, but only 300,000 assistant nurses (Japanese Nursing Association a), meaning that nurses significantly outnumber assistant nurses.

Nurses (n=835) with experience with manual pupil diameter measurement

The average age of nurses with experience in pupil diameter measurements, excluding assistant nurses, was 46.2 years (minimum-maximum range: 25-71). Their average number of years of clinical experience was 21 years and 3 months (minimum-maximum range: 5 months-50 years and 0 months). There were no significant differences between these nurses and nurses with no measurement experience for the measured variables (data not shown).

Pupil diameter measurement method and total number of measurements

We asked about pupillary measurement methods in several questions. The most common method was the

Table 4. Nurses' confidence by number of pupil diameter measurements

n=835

	n	%	Confidence		p-value*
			Average	Median	
1-10 times	107	12.8	2.92	3	.001
11-50 times	175	21.0	3.32	3	
51-100 times	132	15.8	3.51	4	
101 times or more	421	50.4	3.83	4	

* Kruskal-Wallis test

use of a penlight from the front of the eye (536 nurses, 64.2%), followed by the use of a penlight from the side of the eye (458 nurses, 54.9%). Overall, 24 nurses (2.9%) had performed measurements using an instrument such as the NPi-200, of whom 17 had experience with instruments such as the NPi-200 as well as manual measurements. However, we did not ask which type of instrumental measurement was used. One person reported using a fundus machine (Table 3). The biggest group of nurses had taken at least 100 measurements (421 nurses, 50.4%), followed by those who had taken 11-50 measurements (175 nurses, 21.0%) (Table 4).

Confidence in measurement results of nurses with experience in pupil diameter measurement (Table 5)

Nurses experienced in manual pupil measurement were asked about their confidence in the measurement

Table 5. Confidence in pupil diameter measurements of nurses with manual measurement experience

n=826		
Scale (points)	n	%
Extremely confident (6)	18	2.2
Very confident (5)	83	9.9
Somewhat confident (4)	392	46.9
Somewhat not confident (3)	199	23.8
Not very confident (2)	117	14.0
Not confident at all (1)	17	2.0

Excludes eight participants with no experience in manual measurement, who had only used instruments

results. Of the 835 participants, seven who used only instrumental measurements such as the NPi200 and one who used a fundus instrument were excluded. The largest proportion were “somewhat confident” (392 nurses, 46.9%), followed by “somewhat not confident” (199 nurses, 23.8%) and “not very confident” (117 nurses, 14.0%). Approximately 40% of nurses were generally not confident, responding with “somewhat not confident”, “not very confident”, and “not confident at all”. These nurses had an average score of 3.56.

Experience when not having confidence in manual measurement results and referring to values of a previous worker

Overall, 468 nurses had been unsure of values that they had measured manually and had reported the value by referencing records from a previous worker (Table 6). Multiple responses were obtained as to why. Of those, 363 (77.6%) nurses had conducted this as new

recruits, and 181 (38.7%) immediately after moving to departments/hospitals, with 22 (4.7%) nurses reporting that they had conducted this in other situations.

Departments with experience in pupil diameter measurement

Multiple responses were given for questions on the clinical departments where pupil diameter measurement was conducted. The biggest group of nurses worked in internal medicine (374 nurses, 44.8%), followed by neurosurgery (220 nurses, 26.3%) and the emergency department (199 nurses, 23.8%). There were 114 nurses in general hospitals and other institutions, the biggest proportion in intensive care units (26 nurses), followed by 21 nurses in psychiatric departments, 13 in orthopedic departments, eight in the rehabilitation department, and six in the pediatric department (data not shown).

Multiple responses were allowed for the clinical departments of those who conducted measurements using instruments such as the NPi-200. The total number of nurses in university hospitals was four in emergency departments, two each in internal medicine, neurology internal medicine, and surgery, and one each in cardiovascular surgery and neurosurgery. At general hospitals and others, there was one nurse each in the psychiatry and neurology departments. At national and public hospitals, there were three nurses in emergency departments, two nurses each in the surgery and ophthalmology departments, and one nurse

Table 6. Other indicators and confidence levels

n=835						
		n	%	Confidence		p-value*
				Average	Median	
Presence or absence of experience when not having confidence in manual measurement results and referring to values of previous worker**	Presence	468	56.7	3.47	4	.002
	Absence	358	43.3	3.67	4	
JRC guideline knowledge	Knew	142	17.0	4.12	4	.001
	Did not know	693	83.0	3.44	4	
Confidence after knowing that manual measurement has a large margin of error***	No change	365	43.7	3.44	4	.002
	Change	461	55.2	3.65	4	

* Mann-Whitney U-test

JRC: Japan Resuscitation Council

** Nine missing values

*** Excludes eight with experience of measuring using instruments only and one missing value

each in internal medicine, neurology internal medicine, and an integrated facility for medical and long-term care. At other hospitals, there were five nurses in ophthalmology departments, including four with zero beds in their institutions. For other institutions, there were five nurses in emergency departments, four in internal medicine, two each in surgery and neurology internal medicine, and one each in cardiovascular surgery and neurosurgery.

Medical institutions where instrumentation was performed

Multiple responses were allowed for the affiliated medical institution of respondents who took measurements using an instrument such as the NPi-200. Overall, seven worked in university hospitals with 400-1,500 beds, seven in national/public hospitals with 100-800 beds and 13 in other hospitals with 0-500 beds.

Knowledge of the JRC guideline

Of the 835 nurses with experience in manual pupil diameter measurement, 142 (17.0%) knew that the JRC resuscitation guidelines recommended the use of quantitative pupil diameter measurements after 72 hours following ROSC to predict neurological outcome in comatose adults (Table 6).

Changes in confidence after discovering that manual measurement has a large margin of error

As a result of knowing that manual measurement has a large margin of error, 468 nurses (56.7%) responded that their confidence would change. However, 358 nurses (43.3%) reported that their confidence would not change (Table 6). Nine did not respond.

Relationship between variables and confidence in measurement results among nurses with experience in manual pupil diameter measurement

We analyzed the relationship between confidence in measurement results of nurses with experience in manual measurement and their years of clinical experience, measurement method, number of measurements, whether they refer to the values of previous workers, and whether they knew about the JRC guidelines. No correlation was found between years of clinical experience and confidence, with a Spearman's correlation coefficient value of $\rho=0.117$. The Shapiro-Wilk test did not confirm the normality of the confidence data. The relationship with each variable was therefore examined using non-parametric testing.

Significant differences were found in the number of pupil diameter measurements ($p=0.001$) (Table 4), whether the nurse had experience of not having confidence in manual measurement results and referring to values from a previous worker ($p=0.002$) (Table 6); knowledge of JRC resuscitation guidelines ($p=0.001$) (Table 6); and whether the nurse's confidence changed after discovering that manual measurement had a large margin of error ($p=0.002$) (Table 6).

The pupil measurement method was divided into three groups: a group measuring in natural light and penlight from the side of the eye, which is considered correct in physical assessment; a group including the use of instruments such as NPi-200 or other device and manual measurement, and all others. There was a significant association between the three groups and confidence ($p=0.025$) (Table 7), with the confidence level highest in the group using instruments.

Table 7. Pupillometry method and confidence levels of nurses

						n=826
		n	%	Confidence		p-value*
				Average	Median	
Pupil diameter measurement method	Measurement in natural light and Penlight from the side of the eye	549	66.5	3.62	4	.025
	Penlight in front of the eye	260	31.5	3.42	4	
	Use of instrument such as NPi-200 or other device and manual measurement	17	2.1	3.88	4	

*Kruskal-Wallis test

Excludes eight participants with no experience in manual measurement, who had only used instruments

Discussion

This study aimed to explore the experience of clinical nurses working in Japan, determine their confidence in pupil diameter measurements, and examine the extent to which instrumental measurement is used.

The average age of the nurses who responded to our questionnaire was 47.4 years old, and their average number of years of clinical experience was 21.7 years, indicating that the respondents had abundant clinical experience. Overall, 54.2% of nurses had conducted pupil diameter measurements, of whom approximately 50% had conducted at least 100 measurements, indicating that it was a required skill in various clinical departments.

We found less measurement experience than the approximately 80% from a previous report on approximately 500 nurses working in public hospitals (Suzuki and Endo, 2012). It is difficult to speculate on the reason for the difference because the average age of the nurse population in the other study is unknown. However, there may have been many patients who needed pupil diameter measurements in public hospitals.

Nurses who made many measurements had significantly more confidence than nurses who made very few measurements. Our findings therefore showed that confidence increased with the number of measurements. However, the level of confidence was 3.56 out of 6. This is between “somewhat confident” and “somewhat not confident”, indicating that there were nurses who were uncertain whether the measurement results were accurate. These results suggest that opportunities for learning, such as in-hospital training, are necessary for the measurement of pupil diameter. Confidence in the accuracy of pupil diameter measurement might improve with indices for these measurements. The dissemination of instruments capable of quantitative measurement would probably increase confidence among nurses.

Various measurement methods for pupil diameter have been used. Penlights are used to judge light reflexes, but 31.5% of the respondents answered that they had made measurements that were judged to be incorrect. The correct method is to use natural

light and a penlight from the side, and natural light measurement is included in the certified nurse education for stroke rehabilitation nursing (Japanese Nursing Association b, nd). This was proposed in 2008 and started in 2010.

This survey included questions about past experiences, and it is therefore unclear what type of measurement method that nurses were currently using. However, 100% confidence was not reported for the recommended method (natural light and penlight shining from the side). It therefore seems possible that some nurses are not performing measurements correctly. Some may believe that a certain level of illumination is needed during measurements, especially at night. This measurement method using natural light (which is considered correct) is not mentioned at all in the international literature (Nagata et al., 2021). In the future, we plan to conduct measurements with natural light as well as illumination and clarify the evidence from measuring with natural light.

Nurses who followed the physical assessment guidelines (natural light, penlight from the side) had more confidence than those who did not. In a survey of 356 nurses working at a hospital in one prefecture, Osawa et al. (2012) reported that 55% had received education in physical assessment and 41% had not. Takehara (2015) reported from a survey of 82 nurses working in emergency centers and emergency rooms that 89.0% had learned about physical assessment and 11.0% had not. It is possible that those who had learned about physical assessment might be more confident in manual pupil measurement. In this study, we did not ask if the nurses had undertaken any training and therefore cannot make any definitive statements on this issue.

Nurses experienced in manual pupil measurement had little confidence that the results were accurate. It is possible that this may be a sign of anxiety, perhaps because nurses are concerned that they may not notice changes and deterioration in a patient's condition. The mean confidence level of nurses with experience in using instruments was 3.88, significantly higher than the group using manual measurement only. This is probably because experience with instrumental

measurements would confirm the accuracy of manual measurement results. For nurses to be more confident, providing them with more training opportunities will help them to feel more secure. As many as 46% of nurses in this study had never conducted pupil diameter measurements. This suggests that if nurses are assigned to a clinical department that requires measurements in the future and they can perform pupil diameter measurements using an instrument, they will be able to confidently conduct measurements of pupil diameter. Pupillary anomalies are important in evaluating the severity of central nervous system disorders associated with neonatal asphyxia (Nishida, 2018). In the future, studies should investigate whether confidence in measuring pupil diameter differs by nurses' age.

We also examined whether knowing that manual measurement has a large margin of error would change nurses' confidence in their answers. Those who responded that their confidence would change had a significantly higher ($p=0.002$) level of confidence. No significant difference was noted between the two groups in the average age and years of experience of nurses, indicating that those who were more confident in their own measurements were more flexible and willing to accept new knowledge.

Overall, 17.0% of nurses knew that the JRC resuscitation guidelines recommended the use of quantitative pupil diameter measurements after 72 hours following ROSC to predict neurological outcomes in comatose adults. The confidence of nurses who knew this was 4.12, which was significantly higher than among nurses who did not know, whose mean score was 3.44. There was no difference in the age and years of experience between the two groups, indicating that the difference appeared to be in the nurses' ability to absorb new knowledge, increasing their level of confidence.

There was a significant difference in knowledge of the JRC resuscitation guidelines by the presence or absence of measurement experience. However, nurses with experience and knowledge accounted for 17.4% of the total study population, whereas nurses with no measurement experience but with knowledge

accounted for 13.4%, indicating a very low level of awareness of the guidelines. It may therefore take time for the guidelines to become widely known, as they are new and instrumental measurement is not widespread.

The nurses who used instrumental measurement methods were working in medical departments involving many pupil diameter measurements, such as in emergency care, neurosurgery, and internal medicine. However, they were not limited to medical institutions with many hospital beds. We believe that this is linked to the finding that nurses taking more frequent pupil measurements had significantly higher confidence levels. This may show that nurses who carry out more frequent measurements have more confidence in manual measurements, and do not feel the need to use instrumental methods. However, some nurses are not confident in their measurements, and we therefore believe that the introduction of instrumental measurement may be useful because it will allow nurses to establish a standard of accuracy and increase their confidence. Even new recruits can take accurate measurements if they use an instrument. Nurses may become more inclined to use instruments if they are made aware that it is possible to predict the neurological outcomes of comatose adults following ROSC. To the best of our knowledge, no large-scale study to date has investigated nurses' confidence in pupil diameter measurements. We therefore believe that our study provides novel findings that can be used for future comparisons, tracking changes in confidence, and evaluating the skills of new and certified nurses. It is also hoped that instrumental methods will be preferentially disseminated to clinical departments where many measurements have been undertaken. In the future, we believe it will be important for students to learn how to measure with instruments and exchange opinions with clinical nurses.

Study limitations

This study had some limitations. There was potential bias because the participants had to be nurses registered with the research company. Only 24 nurses performed instrumental measurements and it is therefore not possible to conclude with certainty

whether the use of instruments would increase confidence. It is also unclear to what extent clinical departments are affected because this study did not ask about current clinical departments.

Conclusions

The survey was completed by respondents with a wide age range of 25-71 years, an experienced group with approximately 22 years of clinical experience. However, only about half of the nurses had experience with pupillometry and 40% indicated that they lacked confidence in the results of pupil measurement. We found that more frequent pupil measurement was associated with increased confidence. We suggest that nurses' confidence in the results of pupil diameter measurement could be increased by using a quantitative measurement tool that provides an accurate standard and by conducting workshops in the use of this tool.

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Disclosure statement

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臨床看護師の瞳孔測定に関する実態調査

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要 旨

本研究の目的は日本国内で就業している臨床看護師の瞳孔測定に関する経験と自信、および定量的瞳孔径測定をどの程度使用しているのか実態を明らかにすることである。

調査会社に登録している看護職6,197人中1,541人がWeb調査に回答し、有効回答率は24.9%であった。対象者の平均年齢は47.4歳、平均臨床経験年数は21.7年であった。手動での瞳孔測定の経験がある人は全体の54.7%、測定のべ回数経験は100回以上が50%以上であった。定量的瞳孔径測定の経験者は24人のみであった。定量的瞳孔径測定の経験と施設の病床数との間に関連は認められなかった。瞳孔測定の自信度は6段階で平均3.56であり、4割がやや～全く自信がないとの回答であった。今回の調査では、瞳孔測定の経験がある看護師は約半数に過ぎず、40%が瞳孔測定に自信を持っていなかった。これらの結果から、正確な基準となる定量的な測定ツールを使用し、ワークショップを実施することで、看護師の自信を高めることが推奨される。

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